DOCUMENT RESUME

ED 470 978 EF 006 160

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TITLE	Re-Analysis Report: Daylighting in Schools, Additional Analysis. Tasks 2.2.1 through 2.2.5.
SPONS AGENCY	California Energy Commission, Sacramento.
PUB DATE	2002-02-14
NOTE	100p.; Research managed and summary prepared by the New Buildings Institute on behalf of the Public Interest Energy Research (PIER) Program. Full report prepared by Heschong Mahone Group.
AVAILABLE FROM	Full text: http://www.newbuildings.org/pier.
PUB TYPE	Reports - Research (143)
EDRS PRICE	EDRS Price MF01/PC05 Plus Postage.
DESCRIPTORS	*Academic Achievement; Classroom Environment; *Light; School Buildings; Standardized Tests

ABSTRACT

This study expands and validates previous research that found a statistical correlation between the amount of daylight in elementary school classrooms and the performance of students on standardized math and reading tests. The researchers reanalyzed the 1997-1998 school year student performance data from the Capistrano Unified School District (California) and the Seattle Public School District (Washington) to answer questions from the peer review panel. The reanalysis findings are as follows: (1) overall, elementary school students in classrooms with the most daylight showed a 21 percent improvement in learning rates compared to students in classrooms with the least daylight; (2) a teacher survey and teacher bias analysis found no assignment bias that might have skewed the original results; more experienced or more educated teachers ("better" teachers) were not significantly more likely to be assigned to classrooms with more daylighting; (3) a grade level analysis found that the daylighting effect does not vary by grade; (4) an absenteeism analysis found that physical classroom characteristics (daylighting, operable windows, air conditioning, portable classrooms) are not associated with variations in student absenteeism. This seems to contradict claims that have been made about the health effects of daylight or other environmental conditions, as reflected in absenteeism rates of building occupants.These results, which are consistent with the original findings, affirm that daylight has a positive and highly significant association with improved student performance. These findings may have important implications for the design of schools and other buildings. (Appendices contain the survey and data tables.) (EV)

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RE-ANALYSIS REPORT
Daylighting in Schools, Additional Analysis
Tasks 2.2.1 through 2.2.5

Submitted to:
New Buildings Institute
www.newbuildings.org/pier

Integrated Energy Systems
Productivity and Building Science

On behalf of the:
California Energy Commission
Public Interest Energy Research (PIER) Program

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February 14, 2002

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ACKNOWLEDGMENTS

This report is a part of the *Integrated Energy Systems - Productivity and Buildings Science* program, a Public Interest Energy Research (PIER) program. It is funded by California ratepayers through California's System Benefit Charges administered by the California Energy Commission (CEC) under (PIER) contract No. 400-99-013, and managed by the New Buildings Institute.

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Title: Daylighting in Schools: Additional Analysis

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Overall, elementary school students in classrooms with the most daylight showed a 21% improvement in learning rates compared to students in classrooms with the least daylight.
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A grade level analysis found that the daylighting effect does not vary by grade.
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These results, which are consistent with the original findings, affirm that daylight has a positive and highly significant association with improved student performance. These findings may have important implications for the design of schools and other buildings.

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Keywords: Daylight, Productivity, Student Performance, Window, Skylight, Absenteeism, Attendance, Health, Classroom Condition, School Design

Location: www.newbuildings.org/pier

Re-Analysis Summary

Daylighting in Schools, Additional Analysis

February 14, 2001

Summary prepared by New Buildings Institute

on behalf of the
California Energy Commission
PIER Program

Full Report available at: www.newbuildings.org/PIER

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ACKNOWLEDGMENTS

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This Summary Report was prepared by New Buildings Institute. The full *Daylighting in Schools, Additional Analysis* Report was prepared by the following project team:

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These results, which are consistent with the original findings, affirm that daylight has a positive and highly significant association with improved student performance. These findings may have important implications for the design of schools and other buildings.

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Location: www.newbuildings.org/pier

SUMMARY

BACKGROUND

This summary report is a part of the Public Interest Energy Research (PIER) program administered by the California Energy Commission and managed by the New Buildings Institute. Lisa Heschong of Heschong Mahone Group (HMG) led the research; a technical advisory committee has reviewed and accepted the findings. This summary is as an overview of the findings and does not include the technical and statistical details found in the full report.

PREVIOUS STUDY LINKS DAYLIGHT TO STUDENT PERFORMANCE

This reanalysis builds on previous research conducted by HMG and funded by Pacific Gas and Electric Company in 1999. That study found a compelling statistical correlation between the amount of daylight in elementary school classrooms and the performance of students on standardized math and reading tests.[1] These findings, which potentially have very important implications for the design of schools and other buildings where people live, work and play, generated significant attention nationally and internationally.

In the 1999 study, HMG analyzed test score records for more than 21,000 students in three school districts in San Juan Capistrano, California; Seattle, Washington; and Fort Collins, Colorado. The Capistrano study found that **students with the most daylighting in their classrooms progressed 20% faster on math tests and 26% faster on reading tests** over the course of one year, compared to students in classrooms with the least daylighting. The study also found positive and highly significant daylighting effects in the Seattle and Fort Collins districts, even though the three districts studied have different curriculums, different school building designs and different climates.

A panel of experts reviewed the original study and was generally satisfied with the soundness of the methodology and the rigor of the statistical analysis. The reviewers, however, expressed two primary concerns: Were "better" teachers more likely to be assigned to classrooms with more daylighting, thereby confounding the results? And would the analysis be more accurate if performed by grade level rather than aggregating data from four grade levels?

REANALYSIS EFFORT CONFIRMS AND EXPANDS ORIGINAL RESULTS

Prompted by a desire to answer these questions, to validate the rigor of the analysis, and to expand this important research, in 2000 HMG received funding

[1] Heschong Mahone Group (1999). Daylighting in Schools. An investigation into the relationship between daylight and human performance. Detailed Report. Fair Oaks, CA. (http://www.h-m-g.com/Daylighting/daylighting_and_productivity.htm)

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to reanalyze the original study data. The ensuing report presents the methodology and findings of this reanalysis effort. Here, in brief, are the most significant conclusions:

- **Did the reanalysis study validate the original student learning rate findings?** Yes. The reanalysis study found that elementary school students in classrooms with the most daylight showed a 21% improvement in learning rates compared to students in classrooms with the least daylight. This is highly consistent with the range of findings in the original study.
- **Were the original results biased because "better" teachers are assigned to classrooms with more daylighting?** No. Better teachers were not significantly more likely to be assigned to classrooms with more daylighting.
- **Does this daylighting effect vary by grade?** No. There do not seem to be progressive effects as children get older, and younger children do not seem to be more sensitive to daylight than older children.
- **Do physical conditions in the classroom affect student health?** When student attendance is used as the measurement of student health, there is not an obvious connection between physical classroom characteristics (daylighting conditions, operable windows, air conditioning and portable classrooms) and student health.
- **What are the physical classroom characteristics that teachers most prefer?** Teachers had an almost universal desire for more space, a good location, quiet environment, lots of storage and water in the classroom. Windows, daylight and views were desirable but were not driving preferences.
- **Might other factors still be the reason for the variation on test scores?** A wide range of factors potentially affect student test scores, but of the many variables we studied only daylighting showed a strong correlation to improved standardized test scores. All these results were observed with 99.9% statistical certainty.

Rigorous Statistical Analysis Applied to Original and New Data

The reanalysis effort consisted of four research tasks: a teacher survey, a teacher bias analysis, a grade level analysis, and an absenteeism analysis.

The **Teacher Survey** collected information from a sample of teachers in the Capistrano school district about their education, teaching experience, and preferences for classroom features. The survey's primary purpose was to inform the subsequent "assignment bias" analysis. The survey also revealed useful information about teacher preferences, attitudes and behaviors in response to classrooms conditions.

While the teachers surveyed generally preferred classrooms with windows, daylight and views, they considered other classroom features — more space, a good location, quiet, lots of storage and water in the classroom — to be far more essential.

Environmental control was also important. Teachers expected to be able to control light levels, sun penetration, acoustic conditions, temperature and ventilation in their classrooms. They made passionate comments about the need for improvement if any of these conditions could not be controlled.

For the Teacher **BIAS ANALYSIS**, the teacher survey data was statistically analyzed to determine if the original study had over-inflated the effect of daylight on student learning by not accounting for a potential "assignment bias" of better teachers to more daylit classrooms.

We conclusively found that there was not an "assignment bias" influencing the results. A few types of teachers, those with more experience or honors, were slightly more likely (1%–5%) to be assigned to classrooms with more windows or some types of skylights. But considering all teacher characteristics together only explained 1% of the variation in assignment to daylit classrooms.

When we added the teacher characteristics to the original student performance models, the daylight effect was not reduced in significance. We identified a 21% improvement in student learning rates in classrooms with the most amount of daylight compared to those with the least.

In the **GRADE LEVEL ANALYSIS**, we reanalyzed the original student test score data for both Capistrano and Seattle by separate grade level, instead of aggregating the data across grades 2 to 5.

The data showed neither an increase nor decrease in daylight effects by grade level. There do not seem to be progressive effects as children get older, nor do younger children seem to be more sensitive to daylight than older children. Looking at aggregated data across grade levels, we conclude, is a sufficiently accurate methodology.

In the **ABSENTEEISM ANALYSIS**, we used absenteeism and tardiness data in the original Capistrano data set as dependent variables and evaluated them against the full set of explanatory variables from the original study, plus the new information on teacher characteristics. These models allowed us to assess whether daylighting or other classroom physical attributes potentially affected student health, as measured by changes in student attendance.

Student attendance data is certainly not the best indicator of student health. Yet to the extent that attendance data does reflect student health, our findings do not suggest an obvious connection between physical classroom characteristics and student health. Notably, daylighting conditions, operable windows, air conditioning and portable classrooms were not found to be significant in predicting student absences.

LEARNING RATES

In summary, the availability of daylight in classrooms was reliably associated with an increase in student performance and learning rate in the range of 7% to 37%. The central tendency among all the models studied would be a 25% improvement in reading and a 16% improvement in math, or a 21% general improvement between children in classrooms with the most daylight compared to those in classrooms with the least.

Based on these results, if the average student in the district were moved from a classroom with an average amount of daylight to a classroom with maximum daylight, we would expect his or her learning rate to increase by 11%.

FUTURE STUDY WILL ATTEMPT TO REPLICATE RESULTS IN ANOTHER DISTRICT

Overall, these reanalysis efforts affirm that the effect of daylight on student performance is highly significant. Such consistent results present a powerful argument that there is a valid and predictable effect of daylighting on student performance.

The addition of more information to the statistical models did very little to change the predicted impact of daylight on student performance. Thus, we believe that it will be much more informative to try to replicate this study with a different population, at a different school district, than to continue to refine the models with further details and variables. With funding from the PIER program, we have already embarked on a new study with another school district, and look forward to presenting those results in 2003.

The full report is available at www.newbuildings.org/pier

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EXECUTIVE SUMMARY

This report is a follow-on study to the Daylighting in Schools study[1] that was completed in 1999, which found a compelling statistical correlation between the amount of daylighting in elementary school classrooms and the performance of students on standardized math and reading tests. This re-analysis of the original study data was intended to answer key questions raised by the peer review of the earlier study, and expand our understanding of methodological choices for further work.

The original findings potentially have very important implications for the design of schools and other buildings where people live, work and play. Daylight used to be common and even required in schools, homes and offices, but fully daylit buildings became increasingly rare as electric lighting became more the norm. This re-analysis study helps to provide greater certainty for the original findings.

For this re-analysis study HMG conducted four tasks:

The **Teacher Survey** collected information from a sample of teachers in the Capistrano school district about their education and experience levels, preferences for classroom features and operation of those features. The primary purpose of the survey was to provide input to a subsequent "assignment bias" analysis. In addition, we learned some useful information about teacher preferences, attitudes and behaviors in response to classrooms conditions.

While the teachers we surveyed generally had a preference for windows, daylight and views in their classrooms, these preferences were not found to be driving classroom preferences. Far more important was an almost universal desire for more space, a good location, quiet, lots of storage and water in the classroom.

Environmental control was also found to be an important issue for teachers, especially for those who did not have full control. Teachers seemed to hold a basic expectation that they would be able to control light levels, sun penetration, acoustic conditions, temperature and ventilation in their classrooms. They made passionate comments about the need for improvement if one or more of these environmental conditions could not be controlled in their classroom.

The Teacher **Bias Analysis** further examined information from the Teacher Survey. The survey data was coded into variables and statistically analyzed in relation to both assignment to daylit classrooms and the student performance models. The goal of the Bias Analysis was to discover if the original study had over-inflated the effect of daylight on student learning by not accounting for a potential "assignment bias" of better teachers to more daylit classrooms.

We conclusively found that there was not an "assignment bias" influencing our results. None of the individual teacher characteristics we identified were significant in explaining assignment to a daylit classroom in the Capistrano District. Considering all teacher characteristics together only explained 1% of the variation in assignment to daylit classrooms. We did find that a few types of teachers, those with more experience or

[1] Heschong Mahone Group (1999). Daylighting in Schools. An investigation into the relationship between daylight and human performance. Detailed Report. Fair Oaks, CA. (http://www.h-m-g.com/Daylighting/daylighting_and_productivity.htm)

honors, were slightly more likely (1%-5%) to be assigned to classrooms with more windows or some types of skylights.

When we added the teacher characteristics to the original student performance models, the daylight variables were not reduced in significance. Further analysis of other sub-populations repeated these findings. Among twelve models considered, we identified a central tendency of a 21% improvement in student learning rates from those in classrooms with the least amount of daylight compared to those with the most.

In the **Grade Level Analysis**, we re-analyzed the original student test score data for both Capistrano and Seattle by separate grade level, instead of aggregating the data across the four grade levels (2-5). Our goal was to determine if this method would more accurately explain the relationship of student performance to daylighting. We tested for statistical significance and correlation, and we looked at any patterns discovered in the analysis.

The data did not show any significant patterns between a daylight effect and the separate grade levels, neither an increase or decrease in daylight effects by grade level. Thus, we conclude that there do not seem to be progressive effects as children get older, nor do younger children seem to be more sensitive to daylight than older children. Allowing the results to vary by grade did not noticeably improve the accuracy of the models. Therefore, we conclude that looking at data across grade levels is a sufficiently accurate methodology.

In the **Absenteeism Analysis**, we used absenteeism and tardiness data in the original Capistrano data set as dependent variables and evaluated them against the full set of explanatory variables from the original study, plus the new information on teacher characteristics. These models would allow us to assess whether daylighting or other classroom physical attributes potentially impacted student health, as measured by changes in student attendance.

Student attendance data is certainly not the best indicator of student health. Yet to the extent that attendance data does reflect student health, our findings do not suggest an obvious connection between physical classroom characteristics and student health. Notably, daylighting conditions, operable windows, air conditioning and portable classrooms were not found to be significant in predicting student absences.

Overall, the strength of the daylight variable in predicting student performance stands out sharply across all of these re-analysis efforts.

This analysis also demonstrated that the findings of these models are more strongly dependent upon the sample population then the subtleties of the explanatory variables. Thus, we believe that it will be more informative to replicate this study with a different population, to continue to try to refine the models with further detail in the explanatory variables.

1. INTRODUCTION

The Daylighting in Schools study[1] completed in 1999 by the Heschong Mahone Group on behalf of the California Board for Energy Efficiency found some a compelling statistical correlation between the amount of daylighting in elementary school classrooms and the performance of students on standardized math and reading tests.

The study was reviewed by a panel of experts, recruited by Lawrence Berkeley National Laboratory and involved a wide range of disciplines related to the study. In general the review panel was satisfied with the soundness of the basic methodology and the rigor of the statistical analysis. An additional "classroom level analysis" (included in the Appendix of the detailed version) verified the robustness of the initial results. The peer reviewers, however, expressed two primary concerns[2] that could only be addressed in follow-up studies. These are:

1. The results might be confounded by a potential bias whereby "better" teachers might be more likely to be assigned to more daylit classrooms
2. The analysis might be more accurate if performed by grade level, rather than aggregating data from four grade levels together

The study described in this report, supported through the California Energy Commission's Public Interest Energy Research (PIER) program, was designed to address these two concerns, while also expanding other areas of our knowledge about the interaction of students, teachers and daylighting. The series of four tasks described in this report were the necessary first steps in resolving remaining questions about the Daylighting and Schools study. The results of these initial re-analysis studies will also be used to inform the methodology and data collection for the forthcoming PIER productivity studies in schools, retail, manufacturing, and offices.

This report discusses the re-analysis of the 97-98 school year student performance data on standardized math and reading tests from the Capistrano Unified School District in Southern California and the Seattle Public School District in Seattle Washington. The re-analysis of the original study data was intended to answer key questions raised by the peer review of the earlier study, and expand our understanding of methodological choices for further work.

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[1] Heschong Mahone Group (1999). Daylighting in Schools. An investigation into the relationship between daylight and human performance. Detailed Report. Fair Oaks, CA.

[2] Heschong Mahone Group (1999). Daylighting and Productivity. An investigation into the relationship between daylight and human performance. Review Report. Fair Oaks, CA.

1.1 Study Tasks

Four study tasks were defined, which are briefly summarized here, and described fully later:

- Teacher Survey
- Teacher Bias Analysis
- Grade Level Analysis
- Absenteeism Analysis

The **Teacher Survey** surveyed a sample of teachers in the Capistrano school district to determine their years of teaching experience, education level, and other characteristics that might be associated with being a "better" teacher. While we were conducting a survey, we decided to include a few additional questions to learn more about the teacher's perspective on classroom assignments, their preferences for the physical qualities of classrooms, and how they operated their classrooms.

The survey fed into the second task **Teacher Bias Analysis**. The teacher information from the survey was coded into variables that could be analyzed statistically. First we looked at the assignment bias, to see if some types of teachers were more likely to be assigned to more daylit classrooms in the Capistrano District. Next, we added the information about the teachers to the original Capistrano student test score models to see if accounting for teacher characteristics would impact the significance or magnitude of the daylight variables.

In addition to the tasks described above, we also re-analyzed the original data in two other ways. The **Grade Level Analysis** looked at the original student test score data for both Capistrano and Seattle by grade level to see if this was a more accurate way to study the relationship of student performance to daylighting.

The original Capistrano data set also included information on student attendance--both absences and tardiness. This gave us the opportunity to see if daylighting, or other physical characteristics of the classrooms in Capistrano, were associated with changes in attendance. For the **Absenteeism Analysis** task, we set student absenteeism and tardiness as dependent variables, and used the full set of explanatory variables used in the original study, plus the new information on teacher characteristics, to see if daylighting or other classroom attributes were associated with student attendance.

1.2 Literature Review of Research on Teachers' Influence

We looked to research by educational researchers in our effort to understand how teacher characteristics might be described and included in our models. Various educational researchers have analyzed the relationship between teacher performance and student achievement, and have identified a number of teacher

characteristics that seem to fairly reliably predict student learning in the classroom. Factors that have been found to be significant in previous studies include a teacher's general intelligence, teaching experience, certain personality traits, knowledge of the subject matter, knowledge of teaching strategies, continuing education, and certification[1]. The following summary is based on an extensive literature review by Prof. Linda Darling-Hammond of the Stanford University School of Education (Darling-Hammond 2000) of the recent research on the relationship between teacher performance and student achievement. The reader is referred to her report for specific citations or further detail on studies.

This literature review helped inform the classification of teacher characteristic variables for in this study. The discussion below includes both the approach of other researchers to define variables of interest and a brief summary of some of their findings.

General intelligence: General intelligence as measured by IQ test or college grade point average shows the weakest performance as a predictor of subsequent student performance. While early studies in the 40's positively correlated teachers' intelligence and student achievement, these correlations are generally statistically insignificant and have not held up over time. Two meta-reviews of these studies performed in the 80's found little or no correlation.

Teaching experience: Researchers have usually measured teaching experience by the number of years a teacher has spent in the profession. While various studies have found a positive relationship between teachers' experience and student learning, this relationship is not always significant or linear. Although many studies conclude that inexperienced teachers generally perform less well than those with more experience, the benefits of experience tend to level off after approximately five years. This seems, however, to be dependent on the organizational structure of the school district: in districts that emphasize the importance of continuing education, long time teachers are more likely to improve throughout their career.

Teacher personality traits: Studies have found scant correlation between student learning and various teacher personality traits. One exception is a set of personality traits variously defined as "flexibility," "creativity," or "adaptability." This would seem to be consistent with a theory that a teacher's ability to creatively adjust their teaching methods to fit the needs of the students and the instructional goals would correlate positively with student learning. Some researchers have found that "flexibility" is also closely correlated to variables measuring a teacher's professional education, implying that teachers who have studied formally are more likely to be able to adjust teaching strategies for students' different learning styles.

Knowledge of subject matter: Knowledge of the subject matter to be taught, as measured by number of college classes taken or by scores on a subject matter

[1] Darling Hammond, L. (2000). Teacher Quality and Student Achievement: A review of state policy evidence. Education Policy Analysis Archives, Vol. 8, number 1, available on-line, http://epaa.asu.edu/epaa/v8n1/

test, has been found to be less important than might be expected. A variety of studies have shown small, statistically insignificant relationships, both positive and negative. One recent study found that teachers' coursework in the subject field relates positively to student achievement in mathematics and science, but that the number of courses show diminishing returns above a certain threshold level (Monk, 1994). A teacher's knowledge of the subject was found to be more important for higher-level classes and higher-achieving students (Hawk, Coble, & Swanson, 1985). Thus, a certain level of subject matter knowledge appears important, but above that point, other factors, such as the ability to effectively convey this knowledge, become more important to student achievement.

Teaching strategies: Knowledge of teaching strategies has been measured by number of education classes taken in teaching methods and level of college degree (BA or MA). These variables generally capture variance in teacher performance more effectively than the variables discussed above. Ferguson and Womack (1993) studied 200 graduates of one teacher education program. They concluded that the amount of education coursework was responsible for more than four times the variance (16.5 %) in teacher performance than measures of content knowledge, as determined by National Teacher Examination subject matter test scores and GPA in the major (4.5 %).

Continuing education: It is also seems to be important that teachers continue to refresh and update their knowledge through continuing education. Greater student achievement has been linked to mathematics teachers' opportunities to participate in sustained professional development courses. Similar results have been suggested for literature-based instruction. Not only is the amount of ongoing education important, but also how recent it is.

Certification: Standard certification usually requires a teacher to graduate from an accredited teacher training program, have a major or minor in the field to be taught, and pass a test on basic skills and teaching strategies. Therefore, certification status (standard certification vs. emergency, temporary or provisional certification issued to those lacking the above credentials) is a measure of both knowledge of the subject and of teaching skills. Linda Darling-Hammond compiled data from all 50 states using the 1993-94 Schools and Staffing Surveys (SASS) and the National Assessment of Educational Progress (NAEP). She found that at the state level, the percentage of well-qualified teachers (with full certification and a major in their field) was the strongest, consistently positive predictor of student achievement ($.61 < r < .80$, $p<.001$) while the percentage of newly hired, uncertified teachers was the strongest, most consistently negative predictor of student achievement ($-.63 < r < -.40$, $p<.05$).

Scores on state licensing examinations: Another variable that combines several important factors are scores on state licensing examinations, which test both basic skills and teaching knowledge. Ronald Ferguson (1991) examined 900 Texas school districts, controlling for student background and district differences, and found that a combination of teacher qualification variables – scores on a licensing examination, education level, and years of experience -- explained more of the inter-district variation in students' reading and mathematics

achievement gains than student socioeconomic status. The strongest of these variables were the scores on the state licensing exam.

1.2.1 Differences with Our Study

These studies formed a context of our work. However, the goal of our study was not to determine the effect of teachers' credentials, qualifications, and experience on student performance. Our goal, rather, was to discover whether daylighting in classrooms remained a significant indicator of student performance even when teacher characteristic variables were included in a statistical regression model. Thus, our study differed from those discussed above in several important ways.

First of all, our data collection procedure of teacher variables was limited, due to privacy concerns, to the variables we could reliably measure through self-reporting. We had to exclude original sources such as transcripts, college or licensing board test scores, or classroom observations.

Second, the data in other studies was often aggregated to the district or state level. We, on the other hand, analyzed the data at the student and classroom level, which may yield different results or emphasize different factors.

1.3 Summary of Previous Study

For the original schools study we identified three study sites of large school districts that had a range of daylighting conditions in their classrooms. We collected test scores and demographic information for all second through fifth graders in the district, and classified their classrooms for the amount and quality of daylight available. We choose to work with data on elementary school children since they typically spend all year in one classroom. Thus, we could directly isolate the effects of that one classroom. We also specifically selected districts that had a number of classrooms lit from above with skylights or roof monitors ("toplighting"). We reasoned that daylight provided through windows might have a number of complicating factors, such as the quality of view, whereas daylight provided from above typically had fewer other qualities that might influence results, thus we would be more likely to be looking a pure "daylighting" effect.

The three districts were located in San Juan Capistrano, (Southern) California; Seattle, Washington; and Fort Collins, Colorado. These three districts have very different climates, different school building types, different curriculums and different testing protocols. The districts also provided us with information about student demographic characteristics, special school programs, size of schools, etc.

We added information to these data sets about the physical conditions of the classrooms to which these children were assigned. We reviewed architectural plans, aerial photographs and maintenance records and visited a sample of the

schools in each district to classify the daylighting conditions in over 2000 classrooms. Each classroom was assigned a series of codes on a 0-5 scale (see Figure 1) indicating the size and tint of its windows, the presence and type of any skylighting, and a holistic daylighting code indicating the overall quality and quantity of daylight expected from both windows and toplighting combined. In Capistrano, the skylights were given a variable type (A, AA, B, C, D) rather than a scalar. The configuration of these skylight types is described in the original report. The *Daylight Code*, which is used predominately for reporting findings in this report, was based on the following qualitative criteria, with foot candle levels at midday conditions are provided as an illustration rather than a criteria.

Daylight Code 5	Classroom is adequately and uniformly lit with daylight, such that teacher could successfully instruct with electric lights off, for most of the school year. 50± footcandles on most desks.
Daylight Code 4	Classroom has major daylight component, and could occasionally be operated without any electric lights. Daylight may have strong gradient. 30± footcandles on many desks.
Daylight Code 3	Classroom has adequate levels in limited areas, such as near windows. Some, but not all, electric lights could occasionally be turned off. 15± footcandles at some desks.
Daylight Code 2	Classroom has poor and/or very uneven daylight. Not likely to ever operate without electric lights fully on. 10± footcandles in limited areas.
Daylight Code 1	Classroom has minimal daylight. Very small and/or darkly tinted windows or inadequate toplighting. Not possible to operate without electric lights. 5± footcandles in limited areas.
Daylight Code 0	Classroom has no daylight.

Figure 1: Daylight Code Definitions

Ultimately the study analyzed test scores performance for 8000 to 9000 students per district. We looked at both math and reading scores in all three districts, and analyzed each separately, alternately using the holistic daylight code and the separate window and skylight codes, for a total of twelve statistical models.

The Capistrano Unified School District proved to be our most interesting study site for a number of reasons. The District administers standardized tests both in the fall and spring, allowing us to compare the change in students' math and reading test scores while they spent the year in one classroom environment. Because the District, like most in California, has a number of standardized portable classrooms at every elementary site, we were able to use these portables as a standardized condition controlling for the influence of individual school sites or neighborhoods. We also collected additional information at this district about the HVAC and ventilation conditions of the classrooms, which was also included in the analysis.

In Capistrano, using a regression equation that controlled for 50 other variables, we found that students with the most daylighting in their classrooms progressed 20% faster on math tests and 26% on reading tests in one year than those with the least. Similarly, students in classrooms with the largest window areas were found to progress 15% faster in math and 23% faster in reading than those with the least. Students that had a well-designed skylight in their room, one that diffused the daylight throughout the room and which allowed teachers to control the amount of daylight entering the room, also improved 19-20% faster than those students without a skylight. Classrooms with a skylight that allowed direct beam sunlight into the classroom and did not provide the teacher with a way to control the amount of daylight were actually seen to have a negative association with student performance. In addition, in three of the four Capistrano models, the presence of an operable window in the classroom was also seen to have a positive effect on student progress, associated with 7-8% faster learning. These effects were all observed with 99% statistical certainty.

The Seattle and Fort Collins school districts administer only one standardized test at the end of the school year. In these districts, the study used the final scores on math and reading tests at the end of the school year and compared the results to the district-wide average test score. In both of these districts we also found positive and highly significant (99%) effects for daylighting. Students in classrooms with the most daylighting were found to have 7% to 18% higher scores than those with the least.

The three districts have different curricula and teaching styles, different school building designs, and very different climates. And yet, the results of the studies show consistently positive and highly significant effects. This consistency across such diverse school environments persuasively argues that there is a valid and predictable effect of daylighting on student performance.

These models explained from 25% to 44% of the variation in student scores (R^2= .25 to .44). Thus another 56% to 75% of the variation might be explained by other factors not included in our equation such as teacher quality, home life, health, nutrition, individual talents and motivation, etc. There always remains the possibility that some other variable left out of the equation is influencing results on the variable of interest.

Reviewers of the original school study specifically asked if "better" teachers were more likely to be assigned to the more daylight classrooms, thus influencing the results. Additionally, they asked if the analysis might be more accurate if performed by grade level rather than aggregating data from four grade levels together. This follow-on study addresses those concerns by re-examining our most detailed models for the Capistrano district.

2. TEACHER SURVEY

The first task for the follow-up study was to collect additional information about the teachers that could be added to the original models. We choose to work with the Capistrano Unified School District for three reasons: they had provided us with the most detail in the original study, they were willing to cooperate with us on further studies, and they were physically the closest district to us.

2.1 Methodology

We asked the District the best way to compile additional information about the specific teachers in the study that would be useful in our re-analysis. The District was unable to provide us with information about their teachers directly due to confidentiality restrictions. However, they agreed that we could solicit such information from the teachers, in a survey. A survey gave the teachers an opportunity to decline to participate, and allowed us to collect additional information that could be kept confidential from the District.

We agreed that the District would review and approve the instrument, and also help us to locate the teachers in our sample for distribution of the survey. A two-page survey was developed and reviewed by the District and members of our Technical Advisory Committee. A draft version was tested on a number of local elementary teachers for ease of use and clarity.

The final survey, with a explanatory cover letter from the District office, was distributed to a stratified sub-sample of teachers from our original data set. We identified 14 schools with a balanced sample of all window and skylight conditions found in the original 27 elementary schools included in the 97-98 database. Our goal was to achieve a sufficient population of teachers in each daylighting condition, in order to have the best chance to achieve statistical certainty in our new analysis. We provided the District a list of all teacher names used in mapping the data for those 14 schools. The District then located these teachers for us. Over the two year period, between the survey and the original data mapping, about 17% of the teachers had left the district or moved to non-teaching jobs and about 6% had re-located to a different school in the district. As a result, our sub-sample of teachers now resided at every elementary school in the district.

Surveys were mailed to each school office, with a list of teachers to whom they were to be distributed. After two days, the responses were collected in a confidential master envelope and returned to us for analysis. Ultimately, we received completed surveys from 68% of the teachers on our distribution list, or 206 teachers, representing 3900 students in our data set. Some school offices disregarded our list and distributed the survey to all of their teachers, so we received responses from an additional 44 teachers who were not in our original study, for a total of 250 responses.

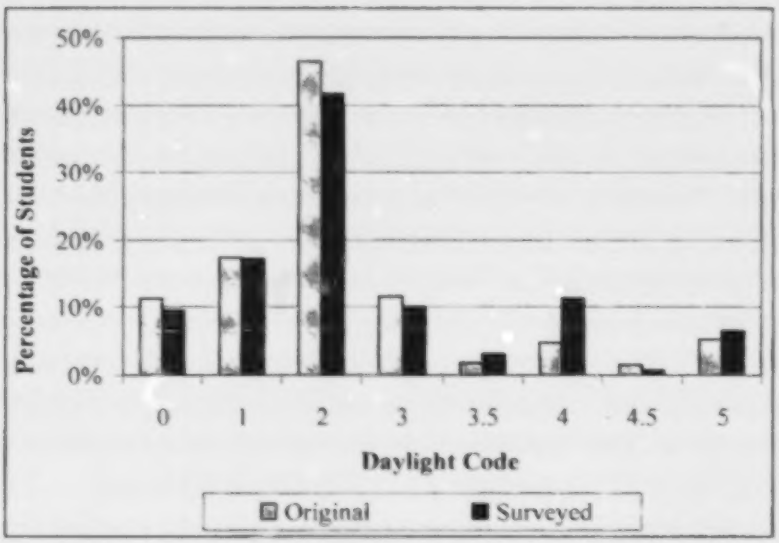

Figure 2: Surveyed vs. Original Population Distribution by Daylight Code

Figure 2 shows the resulting distribution of students by *Daylight Code* for the surveyed population compared to the original population of the study. The two populations are reasonably similar. There is a slight increase in the proportion of teachers in the higher daylight codes (3.5+) due to our concern that our sample include enough teachers to support statistically significant analysis. The reduction in *Daylight Code* 2 reflects a lower sampling of teachers in portable classrooms.

2.1.1 Survey Structure

The two-page survey instrument, provided in Appendix 7.1, contains both structured and open-ended questions. The primary purpose of the survey was to collect information about teacher characteristics that could be included in our models of student performance in daylit classrooms. Thus, the survey first asked for the classroom and grade assignment for both the current year and the 97/98 school year so that we could verify our data mapping. It then asked for the teacher's education level, certificates, additional coursework, special honors, and years of teaching experience—in the current school, district and total.

In addition, we collected information about the teachers' perception of any "assignment bias," their preferences for classroom selection, and additional information about how they operated their classrooms. While this information was not part of the primary intent of the survey, it was hoped that such information might provide valuable insight in future analysis.

Thus, the survey was designed to answer the following questions:

1. What are the educational qualifications and experience of the teachers who taught in classrooms included in the 97-98 data set?

2. Did they believe that they have been allowed to choose their own classroom or have any influence on where they are assigned?

3. If they could choose a classroom, what attributes of a classroom would they give top priority in their selection?

4. How do these teachers operate the energy-using features of their classrooms? For example, if they have operable windows, how often do they open them?

2.2 Teacher Characteristics

The survey responses were categorized, cleaned and entered into a database. Information from open-ended questions was coded for analysis. The teacher characteristic information was eventually transformed into variables for inclusion in the statistical models of later tasks in this study.

The Capistrano Unified School District tries to maintain uniformly high education and training standards among its teachers, which tends to reduce the variation in teacher quality across classrooms. In discussions with Capistrano administrators prior to the survey, we were told that the District was not hiring teachers with provisional or emergency credentials. Beyond requiring all of their teachers to be certified, the district highly values continuing education for all teachers. A sliding salary scale rewards additional college education, in addition to years of experience. The District also provides opportunities for on-site training classes that are specifically tailored to the curriculum needs of the district.

2.2.1 Years of Experience

The 250 teachers who responded to the survey varied in their teaching experience from one or two years to more than 40 years. They averaged 11 years of teaching in the CSUD district and 13.5 years of teaching in total (see Figure 3).

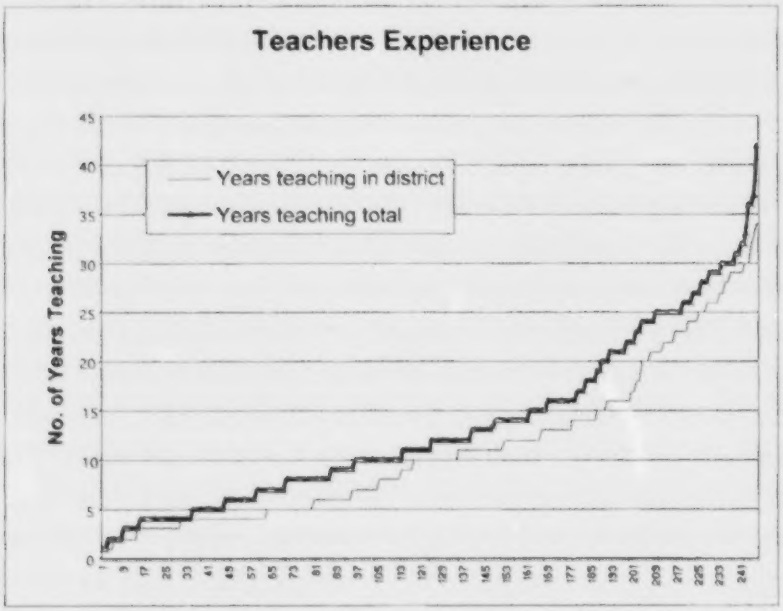

Figure 3: Number of Years Teaching for Survey Respondents

2.2.2 Education Level, Certificates and Honors

Teachers were asked to report their highest educational degree, plus additional college course work, training programs, and special certificates and honors. This information was described qualitatively by the teacher respondents, thus we needed to classify the responses into meaningful categories that could be used to analyze the data. The first step was to understand the educational requirements for elementary school certification in California, and similarly the District's standards for hiring and promotion.

There are two levels of accreditation in California elementary schools. A Preliminary Credential is good for the first five years of teaching. It requires as a minimum completion of a bachelor's degree and a teacher preparation program, knowledge of the US Constitution, plus additional certification in teaching reading, passing a standardized test of knowledge (CBEST) and the multiple subject assessment for teachers (MSAT). The second level of accreditation is called the Professional Clear. It requires an additional fifth year of study beyond the bachelor's including course work in computer, health and special education.

Based on interviews with the District personnel officers and review with our Technical Advisory Group, we decided to group the teachers' education levels for analysis into two simple categories, BA and MA, with three sub-categories, as follows:

"BA" indicated any teacher with a bachelors degree

"Clear only" indicated teachers who had been teaching for 7 years or more, but had not pursued any continuing education beyond that necessary for their professional clear credential.

"BA Plus" indicated teachers who listed college credits beyond the minimum required for certification

"MA" indicated those with a masters, or doctorate (one case)

"MA Plus" identified teachers with college credits beyond a master's degree.

In our sample of surveyed teachers (Figure 4), 58% had Bachelor degree, of which 12% had only a BA and had taught for 6 years or less, 12% were grouped in the Clear Only category, 34% were grouped in the Bachelor Plus category; 42% of the teachers reported having a Masters degree, of which 29% had just an MA, and 13% were grouped in the Masters Plus category,

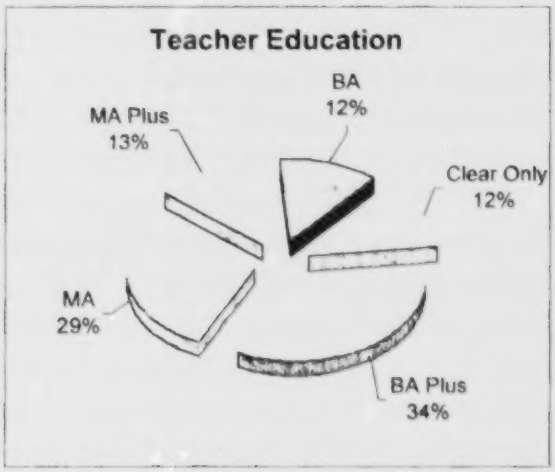

Figure 4: Teacher Education Level

In addition to their qualifications, teachers also reported other credentials that identified if they have received any special certificates or honors. From this information we defined two other analysis categories:

- The ***Certificates*** category included teachers, who reported special certificates beyond those required for the CLEAR credential, such as a certificate in bilingual or gifted and talented education.
- The ***Honors*** category grouped together all teachers who reported special awards or honors, such as being named a mentor teacher or Teacher of the Year.

Figure 5 shows the proportion of surveyed teachers who were classified into these two categories.

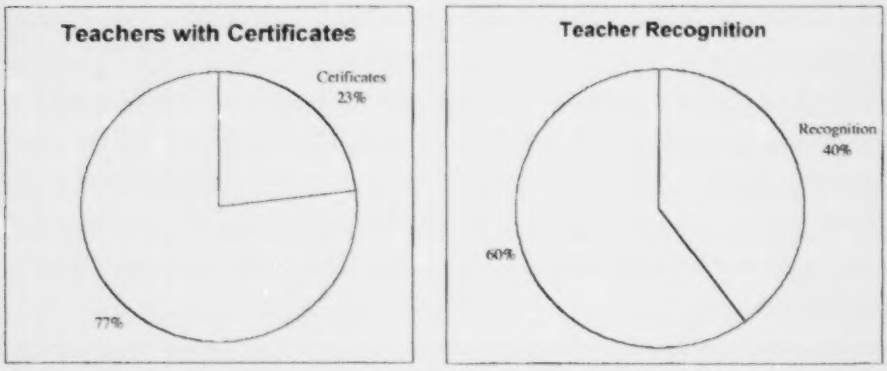

Figure 5: Teacher Certificates and Honors (Recognition)

2.2.3 Classroom Preferences

We pursued a number of different methodologies to understand if there was an intentional or unintentional bias in assigning some teachers to more daylit classrooms. In our original study we had interviewed administrators and principals in the district, who assured us that there was no obvious mechanism or practice of assigning "better" teachers to more daylit classrooms. Given the rapid growth of the district, frequent reassignment of classrooms to accommodate new school openings and added portable classrooms tended to randomize teacher classroom assignments on a fairly regular basis. In addition, it was reported that each school site follows its own administrative criteria in assigning teachers to classrooms, using criteria such as clustering of grade levels or special interest teaching teams.

From the Teacher Survey we found a slightly different story. Of the teachers surveyed, 32% felt that they may have had *some* influence on the selection of their classrooms within the past year (a yes answer to Question 14) and 41% answered yes or maybe. Similar percentages reported that they may have had past influence. Thus, the teachers seemed to feel that they could influence classroom selection.

When asked to indicate their top criteria for selection of a classroom, if they were to have a choice (Question 15), 8% of the sample ranked windows or natural light as their top criteria, and 27% mentioned windows, natural light or view within their top three choices. Lumped together, these three criteria would have placed fourth in importance as a classroom selection criteria, after classroom size (53%), convenient location (36%), and storage capacity (30%). (See Figure 6 and discussion in Section 2.2.4 below.) Thus, while windows and associated qualities light natural light and view are important to teachers, they are not the most important criteria that teachers claim drive their choices.

In addition to the structured questions, teachers were given the opportunity to write any comments they wished. Over two hundred, or 80%, took the

opportunity to write informative comments, while three complained about not enough time to respond. (See Appendix 7.1.3 to read the un-edited comments) Their comments read as a loud plea for better physical conditions in the classroom. The reader should realize that many of the comments are referring to class-size reduction measures that were instituted in the District to increase the number of teaching spaces, but unfortunately have compromised physical comfort and control. The passion for control of physical conditions--lighting, acoustics, ventilation and thermal comfort--is also very evident in these comments. The list of comments should make compelling reading for anyone managing or designing school facilities.

2.2.4 Criteria for Classroom Selection

The survey, in an open-ended question, asked what were the three most important criteria that the teacher would use to select a classroom, if they were given the choice. We grouped the qualitative responses into the following categories, reported in the order of their frequency of mention within the top three criteria:

- *Size* indicated teachers' preference for larger classrooms and was most frequently listed in the top three criteria, mentioned by 53% by respondents. It was also the most frequently listed as the top preference.
- *Location* of the classroom within the school layout was the second most common criteria in determining their classroom choice (36%), and was also second as the top criteria. The location preferences included close proximity to the school entrance, administrative offices, playground, library, or other elements of the school plan.
- *Storage* space inside the classroom in the form of closets or cupboards was the third most mentioned criteria.
- *Water* or the availability of a sink in the room was among the top four most mentioned criteria. Comments typically emphasized the primary importance of water in the classroom for student hygiene, and secondarily for class projects.
- *Quiet* captured criteria such as "lack of noise" and "being in a quiet zone." It was the fifth most common criteria (23%) mentioned in any of the top three preferred classroom attributes by teachers, and third criteria in terms of teachers' top preference (after classroom size and location).
- *Windows* were mentioned by 20% of the respondents.
- *HVAC* indicated a preference for air conditioning in the classroom, or control of temperature, or acceptable thermal comfort conditions.
- *Door* indicated a preference for full enclosure or the availability of a door to close off the classroom from other activity areas.
- *Proximity* indicated a preference for a classroom close to particular colleagues, either by grade level or shared teaching responsibilities.

- *Condition* indicated a preference for better physical conditions, such as new paint, furniture or carpet, or good maintenance.
- *Ventilation* indicated a preference for fresh air or good air circulation.
- *Lighting* indicated preference for a good lighting quality in the classroom or control of the lighting levels.
- *Natural light* indicated a preference for natural light from windows or skylights.
- *Walls* indicated a preference for lots of wall surfaces for display.
- *Bathroom* indicated a preference for a bathroom close by.
- *Views* indicated a preference of a good view from the classroom.
- *Whiteboards* indicated a preference for lot of whiteboard surfaces.
- *Phone* indicated a preference for a telephone available in the classroom.
- *Workroom* indicated a preference for being adjacent to a teacher workroom.

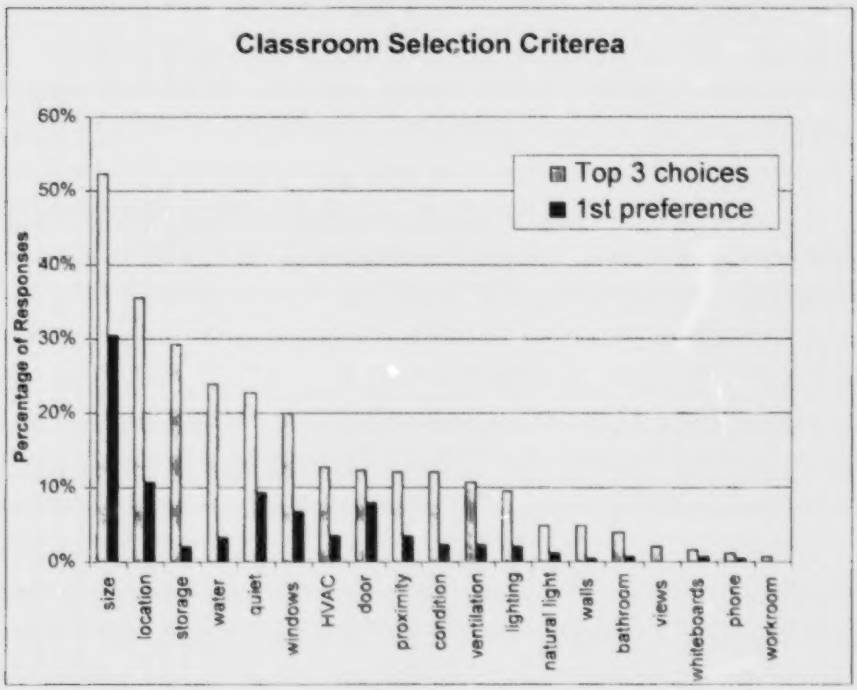

Figure 6: Most Preferred Attributes of Classrooms

It should be noted that the teachers' preferences for classroom features is largely a function of what options are, or are not, currently available to them. For example, a teacher in a school without windows but the option of moving to a portable with a window may rank windows very high, while a teacher in a

classroom with large windows but no sink, may rank access to water highest. Thus, we interpret these results to be particular to the context of the Capistrano Unified School District and the status of current facilities.

2.2.5 Permanent vs. Portable Classroom Preference

The use of portable classrooms in California was mandated by the state for a number of years as a strategy to accommodate rapidly shifting population growth. As a consequence, every school site in our Capistrano study had a substantial number of portables. Portable classrooms have also come under recent scrutiny for possible poor indoor air quality or other health concerns such as mold growth. A number of state and national studies are currently trying to assess the health implications of portable classrooms. Our 1999 study did not find any negative student performance impacts associated with portables. Indeed, our models tended to find positive, but not statistically significant impacts, associated with being in a portable classroom, once we controlled for daylight, ventilation and all other variables in our equation. To learn more about teacher's perceptions of portables we included a question about preference of portable or permanent classrooms in the survey (Question 16). The answers and associated comments are fully presented in Appendix 7.1.2.

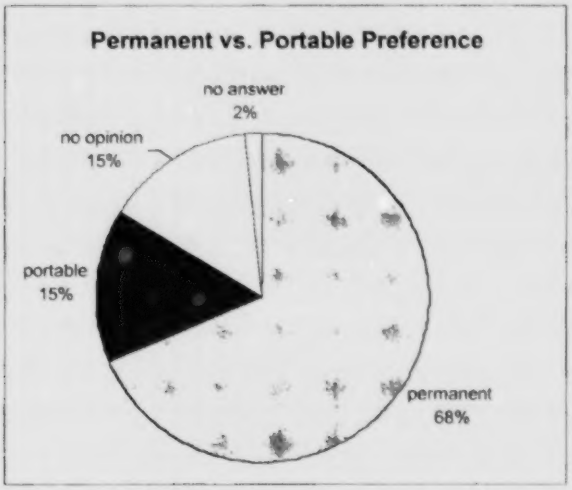

Figure 7: Permanent vs. Portable Classroom Preference

Sixty eight percent of the teachers surveyed preferred to teach in a permanent classroom rather than a portable one. (Figure 7). Thirty percent of the respondents were divided equally between those who preferred portable classrooms or reported no preference for either type.

48% of the teachers that preferred portables mentioned that the closed walls of the portable solved the noise and distraction problems found in the permanent classrooms of their school created by an open classroom plan or poor acoustics. 24% preferred portables because they were larger than the permanent

classrooms available at their school. Remaining comments mentioned the presence of air conditioning, better bulletin boards, and better physical condition.

Teachers who preferred permanent classrooms had a much wider range of reasons why. Larger size, better location, better amenities, less noise were frequently mentioned. One teacher summed up a preference for permanent classrooms in the comment: "Feels substantial and lets children know they are important and that things are not temporary." 22% of teachers preferring permanent classrooms specifically mentioned indoor air quality concerns, such as moldy or musty smells and increased incidence of allergies or colds in portables.

2.2.6 Classroom Energy Management

In the survey, teachers were asked how they operated a number of energy using features in their classrooms. The data that we have for the Capistrano classrooms merely indicates the presence of a feature, such as operable windows, not whether or how it is used. This set of questions was intended to provide insight into how their might actually use these features, and provide some baseline data, admittedly self-reported, that might allow us to estimate the energy impacts of various features.

Figure 8 highlights the percentages of teachers' responses for the ten energy statements surveyed. Positive percentages indicate actions taken, while negative percentages indicate inability to act, or no action.

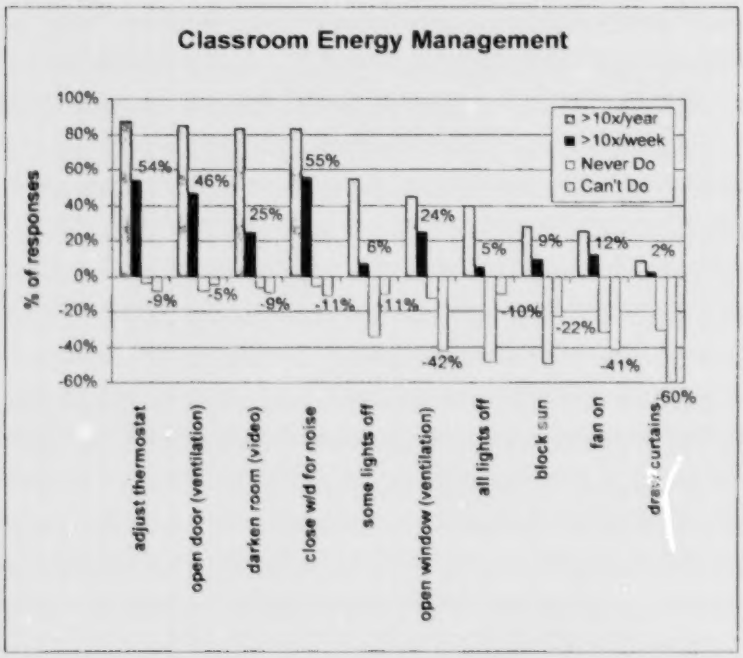

Figure 8: Teachers' Energy Management of Classrooms

HVAC control: Over 50% of the teachers' surveyed reported adjusting the classroom thermostat on a weekly basis, and almost 90% of them reported doing this more than 10 times/school year (about monthly).

Acoustic control: Over 80% of the teachers occasionally close the windows or doors ("close w/d for noise") to avoid high noise levels from the outside, and 55% do this frequently.

Ventilation control: 46% open the outside door for ventilation purposes on a weekly basis and 84% do this at least 10 times every year. 25% of the teachers surveyed reported doing this on a daily basis. More than 40% of the teachers surveyed reported they can't open a window for natural ventilation, while 42% of the total sample open a window at least 10-times/school year. 12% of the teachers report using a portable fan, which probably means they brought in their own personal fan that they purchased themselves to solve a perceived ventilation problem in their classroom.

In the comments section, one teacher summarized the teaching challenges faced with in small, poorly ventilated portable: "The students do not have enough space to move around. Most large projects are eliminated because of lack of space and no access to water. The room is so small that we use the ramp outside to set up centers. The door is always open because the poor circulation in the room gets us sick. We have no water to wash our hands after sneezing and coughing…we get sick more often and pass colds, flu to each other because of our close proximity."

Lighting control: Darkening the room for TV or video is also very common, done by over 80% occasionally and 25% frequently. Turning some or all lights off is also a fairly common activity, while taking measures to block the sun, or close curtains is much less frequent.

Figure 9 shows further detail on teachers' management of the electric lighting in their classrooms. This graph shows 54% of the teachers turning <u>some</u> of the lights off, and 37% of the teachers turning <u>all</u> of the lights off, at various frequencies during the school year.

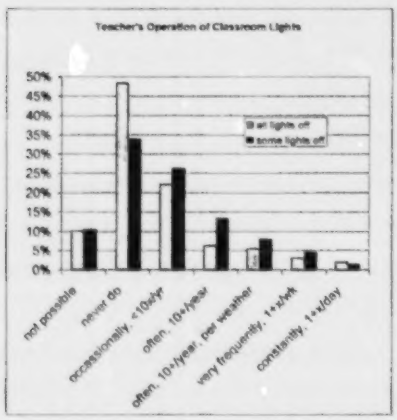

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Figure 9: Teachers' Lighting Management of Classrooms

2.3 Conclusions

The results of the teacher survey on preferences and operation of classrooms suggest that daylighting and operable windows are indeed important to teachers, but tend to be secondary to their most pressing concerns, such as adequate size, location, and water (hygiene) availability in classrooms. Acoustic, thermal and visual comfort and adequate ventilation are all frequently listed as top priorities.

The optional comments response to the survey was overwhelming. 98% of the teachers surveyed took the time to write about what was good and bad in their classrooms. The passion put into the comments on physical comfort in classrooms makes it clear that teachers are very stressed by any type of poor physical condition in classrooms where they must work every day with 20-30 very active children. "Please help California get more square footage per child. It's crazy!" pleaded one. "Teaching ... without running water makes me feel like it's the 1900's. We carry pails of water!" exclaimed another. One teacher concluded about the need for cross ventilation: "I believe it is good for myself and students to breathe in some fresh air. It helps us all think." While some teachers report being pleased and comfortable with their classrooms, a sizable group feel they have overwhelming physical challenges in their classrooms that routinely interfere with their ability to teach.

There are clearly some important energy use challenges revealed in the survey that should be carefully considered by school designers and facility managers. In Figure 8 it is clear that Capistrano teachers are actively trying to increase the ventilation of their classrooms by opening doors, opening windows, and adding portable fans. Furthermore, 54% claim to be adjusting the thermostat at least once a week and 55% also claim to be closing windows or doors at least once a week specifically to control noise in the classroom, implying that they had previously opened them, most likely for ventilation. This suggests that teachers' driving desires for good ventilation, thermal comfort and acoustic comfort tend to be in conflict with the options allowed by their physical environment. Increasing ventilation is likely to also increase ambient noise in the classroom and/or reduce thermal comfort. One teacher summarized this problem with the comment: "I like being able to adjust the a/c, heat and ventilation. The down side of this is the a/c unit makes a lot of noise and makes hearing students and teacher more difficult, so you have to raise your voice, ask for repeats or be very stuffy and uncomfortable during oral readings and discussions."

The Capistrano school district is in a relatively mild climate in Southern California, where ambient temperatures are often in the comfort zone, allowing natural ventilation without supplementary heating or cooling. However, even in Capistrano, it is highly probable that substantial energy is wasted running heating or cooling systems while classroom doors and windows are open. Simply improving the efficiency of the heating and cooling systems will not solve this

problem. Rather, given teachers' strong desire for more ventilation, classroom design should include systems that allow increased ventilation without increasing energy use for heating or cooling.

Lighting energy use is also an important issue for schools, constituting a large percentage of overall energy use. The provision of daylighting in classrooms only saves energy if electric lights are turned off when not needed, either manually or automatically. The results in Figure 9 suggest that a manual lighting control scheme has an likelihood of being operated by about half of the teachers in a school. This behavioral element should be factored into any proposed lighting control scheme. While automatic systems may be effective more often, their cost-effectiveness should be compared to manual systems that are occasionally operated by 50% of the teachers.

The information in the Capsitrano teacher survey is not comprehensive enough to draw any universal conclusions about teacher preferences or behaviors. However, it is strongly suggestive that the physical environment is a key factor in teaching effectiveness, and that teacher preferences for classroom operation need to be given high priority in the design of comfort systems and classroom controls.

3. TEACHER BIAS ANALYSIS

Once the information in the teacher survey was categorized and compiled into a database, we were able to analyze the data for a potential bias in teacher assignment to more daylit classrooms. This task was pursued with a variety of analytic approaches.

3.1 Hypothesis

For this task we set out to test the hypothesis that the higher rates of learning in daylit classrooms might be attributable to "better" teachers being located in more daylit classrooms. For this discussion "better" teachers would be defined as those who are responsible for faster learning rates in their students, as reflected in the rate of progress measured by standardized math and reading tests. Daylit classrooms would be defined by the *Daylight Code* assigned to each classroom in the original study.

3.2 Methodology

In order to study this question we needed to 1.) find a way to identify potentially "better" teachers 2.) determine if the "better" teachers were being differentially assigned to more daylit classrooms and 3.) determine to what extent the magnitude or significance of the daylighting effect would change if information that could predict teacher quality could be included in the model.

Our first step was to define the specific teacher variables to be included in the models, based on the data we had collected in the early Teacher Survey task. In order to do this, we needed to understand the basic structure of educational requirements for a California Elementary School Teacher's credential, along with the hiring and promotional policies of the district. We collected this information from the Department of Education web site, the Capistrano District personnel office, and by interviewing various district administrators.

3.2.1 Teacher Credentials

In discussions with Capistrano administrators prior to the survey, we were told that the District was not hiring teachers with provisional or emergency credentials. Beyond requiring all of their teachers to be certified, the district highly values continuing education for all teachers. A sliding salary scale rewards additional college education. The District also provides opportunities for on-site training classes that are specifically tailored to the curriculum needs of the district.

In the teacher survey we asked teachers to report on their years of teaching in the current school, district, and total; their highest level of education; additional

course work or certifications; and special awards or recognition. This information was all self-reported and described in the teacher's own words. We subsequently categorized this information into the eight variable codes described below.

Teaching Experience: We defined the variable of *Log Yrs Teach* as the natural log of the total number of years teaching. By using a natural log we attempted to account for the diminishing effect of additional years of experience reported in the research literature.

Level of Education:

BA indicated any teacher with a bachelors degree. Reported as Teacher 1.

Clear only indicated teachers who had been teaching for 7 years or more, but had not pursued any continuing education beyond that necessary for their professional clear credential. Reported as Teacher 5.

BA Plus indicated teachers who listed college credits beyond the minimum required for certification. Reported as Teacher 2.

MA indicated those with a masters, or doctorate (one case). Reported as Teacher 3.

MA Plus identified teachers with college credits beyond a master's degree. Reported as Teacher 4.

Certification: This variable was used to identify teachers who had received any special certificates or credentials, beyond the minimum required for a California elementary multi-subject credential. Special certificates for Bilingual Education, Gifted and Talented Education, Special Education, etc. were grouped together under one variable. Reported as Teacher 6.

Honors: Many teachers reported receiving special awards, such as Teacher of the Year, or being selected to be mentor teachers. Because responses varied, and because we had little way of measuring how prestigious the awards were, any teacher that reported receiving an award or being chosen to be a mentor teacher was indicated by the *AwarMent* variable. Reported as Teacher 7.

The teacher characteristics variables were added back into the master data set. The surveyed population of teachers represented about 1/2 of the original data set. Thus, for about 1/2 of the student records we added the information characterizing their teacher's years of experience, education level, special certificates or honors. The remainder of the student records were given an indicator variable for no teacher information.

3.2.2 Assignment Bias

Once we had defined the teacher characteristic variables, we looked to see if there were any significant correlations between these teacher characteristics and

the daylight conditions in the classrooms in our Capistrano data set. This was our first statistical test for a teacher assignment bias. If we found a strong pattern of correlation between a few teacher variables and a few daylight codes, then it was likely that some types of teachers were being differentially assigned to more daylit classrooms. In this first pass at the analysis we included all of the window related variables, including the daylight code, window code, skylight codes, and operable windows.

The analysis was based on the data collected in the teacher survey, described in the preceding section. We used the data from surveys of 206 teachers. These teachers taught 3,948 of the students included in the original study. To be consistent with the original study, the first pass statistical analysis was carried out at the student level. In other words, each student was been taken to be an observation. Since the number of students per teacher in our data set varied somewhat independently of the number of total students in a classroom, this approach has the effect of weighting the results according to the study population database. Because of the large number of student observations, it also tends to exaggerate the significance of the correlations.

Looking the student level, we found a statistically significant (2-tailed, $p<.10$), correlation among almost all of the variables (see Figure 10). We found no obvious pattern of any variables less likely to have correlations than others. Furthermore, the magnitude of correlation was minor throughout. The strongest correlation, at $p=.01$, was between *Teacher 7* and *Skylight Type B* (a Pearson Correlation of .227), implying that 5% ($.227^2$) of classroom assignments might be explained by this correlation. Nine other combinations had a Pearson Correlation between 0.1 and 0.2 and all others (61%) were below 0.1[1], indicating a very weak magnitude of correlation.

Variable		Daylight	Window	AA Skylight	A Skylight	B Skylight	C Skylight	D Skylight	Oper. Win.
Teacher 1	Pearson Correlation	0.089	0.068	-0.062	0.111	0.026	-0.001	0.015	-0.106
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.012	0.905	0.144	0.000
Teacher 2	Pearson Correlation	0.044	0.020	-0.076	0.048	0.085	-0.041	0.064	0.019
	Sig. (2-tailed)	0.000	0.050	0.000	0.000	0.000	0.000	0.000	0.067
Teacher 3	Pearson Correlation	0.069	0.112	-0.001	-0.021	0.028	-0.018	0.020	0.004
	Sig. (2-tailed)	0.000	0.000	0.914	0.039	0.007	0.082	0.058	0.718
Teacher 4	Pearson Correlation	0.083	0.080	0.109	0.013	0.077	-0.021	-0.025	0.018
	Sig. (2-tailed)	0.000	0.000	0.000	0.218	0.000	0.048	0.015	0.081
Teacher 6	Pearson Correlation	0.066	0.051	-0.026	0.087	0.047	-0.039	-0.035	-0.034
	Sig. (2-tailed)	0.000	0.000	0.011	0.000	0.000	0.000	0.001	0.001
Teacher 7	Pearson Correlation	0.150	0.147	0.056	-0.096	0.227	-0.067	-0.012	-0.030
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.246	0.003
Log yrs teach	Pearson Correlation	0.138	0.171	-0.005	-0.007	0.097	-0.071	0.022	0.015
	Sig. (2-tailed)	0.000	0.000	0.659	0.499	0.000	-0.000	0.033	0.143

N= 3948 students

Figure 10- Correlation of Teacher Variables to Daylight Variables, Student level Analysis, Capistrano

[1] The *Teacher 5* variable had not been defined at this time, so was left out of this correlation table.

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In a second pass, we also re-calculated the correlations using the 206 teachers as independent observations. Using the smaller teacher population, un-weighted for student population in our data base, presented a more extreme test for significance. Out of the 56 correlations that are reported in Figure 9, ten were judged to be potentially significant with p-values of .10 or less at the teacher level. None of the correlations with the *Daylight Code* were significant. Skylight Type AA did show a pattern of correlations, but with only 5 surveyed teachers in this group, we discounted this as a random result. The most interesting finding was a slight indication that more senior teachers (Log yrs teach) had some influence being assigned to classrooms with larger window areas, operable windows, or skylight types A, and that Teacher 7 (honors) were more likely to be assigned to skylit classrooms type A or B. The magnitude of a possible effect is minimal, with only 1% to 5% of the variation in assignment to these classroom types potentially explained by either of these variables.

We concluded from this exercise that there was indeed some potential for an assignment bias relative to honors or years of experience, but that a two-dimensional correlation analysis was not a sufficient tool to determine its magnitude or influence on the results of the multi-variate regression models.

3.2.3 Decision to Focus on Daylight Code Only

For simplicity sake, we choose to work henceforth with just the *Daylight Code*. Tracking the change in performance for one variable, instead of eight, reduced the complexity of the task dramatically. We choose to focus on the *Daylight Code* since it was the holistic code that combined the effects of the window and skylight codes together. It had been very robust in the previous analysis, and described the classroom characteristic of greatest interest.

By focusing our attention on just the change in the *Daylight Code* across models, we were more likely to see patterns across models.

3.2.4 Daylight Code as a Dependant Variable

Next we ran a regression model with the *Daylight Code* as the dependant, or outcome, variable and the teacher characteristic variables as the independent, or explanatory variables. This model was run using only the surveyed teacher population. This model would tell us more precisely if there was indeed an "assignment bias," such that some teacher types were more likely to be assigned to daylit classrooms. It was a more precise test than the correlation tables, since it allowed the influence of each teacher characteristic variable to be assessed simultaneously.

From this regression model, we found that there were NO teacher characteristics, as defined by our variables from the survey data, that were significant in explaining assignment to more daylit classrooms. The variable that achieved the highest probability of influence was Teacher 7 (honors) at only 78% likelihood of significance (p=.22) that there might be a 5% higher assignment in

Daylight Code (A teacher who had received an honor or award had a 78% probability of being assigned to a classroom rated 3.15 on the daylight scale instead of a 3.0). The other variables had a 50% probability or less.

The R^2 for this model was only 0.014, indicating that all of the teacher characteristic variables could explain only 1% of the variation in assignment to daylight classrooms. When we ran a similar model at the student level, the level of explanation increased to 2%. Thus, from this exercise we conclude that the Capistrano Unified School District did not have any marked bias in the assignment of teachers to more daylit classrooms, based on the teacher characteristics that we studied.

3.2.5 Teacher Assignment Bias Models

Our final step in the Teacher Bias Analysis was to re-run the original Capistrano student performance models with the teacher characteristic variables added to the list of potential explanatory variables. Again, we choose to focus our reporting on the results of the *Daylight Code* for simplicity, although we did also run the separate models with the window and skylight variables. The original models were re-run for both change in reading and math scores at the student level. Teacher characteristic variables were added for 42% of the population.

It should be noted that the performance of the observed students within a given classroom may not be mutually independent. In the original research, we carried out a special analysis to assess the effect of correlation between students within a given classroom (See Appendix 6.2 to original report, dated 6/29/1998). This analysis indicated that the statistical significance of some of our results was somewhat overstated but the effects of interest were not substantially altered. However, carrying out the analysis at the student level made it easier to explore the relationship between characteristics of the student, teacher, room, and school.

3.3 Findings

Figure 12 and Figure 11 display the findings of these two models, compared to the original models without the teacher variables. The school site variables and outliers have been left off of the equations shown here for simplicity, but are included in the full model detail in the Appendix 7.2. A central column shows the change in the B coefficient for each variable and the model R^2.

New Model Capistrano, Teacher Analysis - 28-2 (Original population)	Math Daylight			Change new-old R^2	Old Model Capistrano, Original Analysis C17-md	Math Daylight		
Model R^2	**0.259**			**0.003**	**Model R^2**	**0.256**		
	B	Std. Error	p (Signif)	B		B	Std. Error	p (Signif)
(Constant)	9.045	0.464	0.000		(Constant)	8.026	0.407	0.000
Classroom characteristics					Classroom characteristics			
Daylight code	0.430	0.072	0.000	**-0.075**	Daylight code	0.504	0.067	0.000
Teacher characteristics								
Teacher 3	-0.933	0.248	0.000					
Teacher 5	-0.688	0.335	0.040					
Log yrs teaching	0.373	0.077	0.000					
Student characteristics					Student characteristics			
Grade 2	9.624	0.216	0.000	-0.088	Grade 2	9.711	0.215	0.000
Grade 3	5.949	0.220	0.000	0.018	Grade 3	5.931	0.219	0.000
Grade 4	1.802	0.216	0.000	-0.011	Grade 4	1.813	0.216	0.000
Absences unverified	-0.263	0.123	0.033	0.000	Absences unverified	-0.263	0.123	0.032
Absences unexecused	-0.029	0.014	0.043	-0.003	Absences unexecused	-0.026	0.014	0.069
GATE program	-1.191	0.222	0.000	0.045	GATE program	-1.236	0.223	0.000
Language program	0.488	0.205	0.017	-0.001	Language program	0.490	0.205	0.017
School characteristics					School characteristics			
School Pop-per 500	-0.995	0.000	0.000	-0.483	School Pop-per 500	-0.512	0.000	0.010

Figure 11 - Change in Capistrano Math Model with Addition of Teacher Variables

New Model Capistrano, Teacher Bias Analysis - 28-2 (Original population)	Reading Daylight			Change new-old R^2	Old Model Capistrano, Original Analysis C17-rd	Reading Daylight		
Model R^2	**0.248**			**0.002**	**Model R^2**	**0.246**		
	B	Std. Error	p (Signif)	B		B	Std. Error	p (Signif)
(Constant)	3.009	0.303	0.000		(Constant)	3.025	0.298	0.000
Classroom characteristics					Classroom characteristics			
Daylight code	**0.475**	**0.086**	**0.000**	**0.011**	**Daylight code**	**0.464**	**0.085**	**0.000**
Operable windows	0.650	0.212	0.002	0.007	Operable windows	0.643	0.212	0.002
Teacher Characteristics								
Teacher 3	-0.917	0.288	0.001					
Teacher 5	-1.335	0.388	0.001					
Log yrs teaching	0.221	0.090	0.014					
Student characteristics					Student characteristics			
Grade 2	10.823	0.251	0.000	-0.037	Grade 2	10.860	0.251	0.000
Grade 3	4.368	0.255	0.000	0.069	Grade 3	4.298	0.254	0.000
Grade 4	0.944	0.252	0.000	0.008	Grade 4	0.937	0.252	0.000
GATE program	-1.432	0.257	0.000	0.020	GATE program	-1.452	0.257	0.000
LANG program	0.827	0.239	0.001	-0.011	LANG program	0.838	0.239	0.000

Figure 12 - Change in Capistrano Reading Model with Addition of Teacher Variables

Even with the addition of the teacher characteristic variables into the original models, the daylight variable stayed highly significant in both cases. For the math model, with the outcome variable as the change in fall to spring math scores, the magnitude of the daylight effect decreased slightly.

For the reading model, the magnitude of the daylight effect actually increased. In the case of the reading model, operable windows also remained a significant variable, and also increased slightly in magnitude.

Three of the eight teacher characteristic variables were found to be significant in both models. (While the significant teacher variables here were consistent, they

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were not consistent in the models using window codes and skylight types as explanatory variables, nor were they consistent in later models that we ran, discussed later.)

With the addition of information about the teachers, the R^2 of the models increased, but only by a tiny amount, increasing their power of explanation by less than 1%.

3.4 Conclusion

Thus, we conclude that the strength of the daylight variable showed in the original analysis was not an inadvertent effect of a "teacher assignment bias." We have shown in the regression model of the *Daylight Code* versus the teacher characteristic variables, that the teacher characteristics captured in our survey only explained 1% of the variation of teacher assignment to daylit classrooms. Furthermore, in the master student performance regression models adding information about teacher characteristics for 42% of the population did not reduce the significance of the daylight variables. As might be expected, the magnitude shifted slightly; in one case down, in one case up.

3.5 Discussion

One potential weakness in the findings above is that we only had teacher characteristic information for less than half of the study population. We decided it would be a good test to re-run the models for just the population of students represented by teachers who responded to the Teacher Survey. That way, we could look at a model where 100% of the population had information about the teachers. This "surveyed population" model included 206 teachers and 3948 students, or about 50% of the original population.

We were aware that if we shifted the sample population for a model, we ran the risk of getting different results. But we wanted to examine the stability of the daylighting coefficient in our models over different sample populations. We also wanted to explore the stability of including the information about the teachers. Thus, we decided to run similar models to the original Capistrano math-daylight and reading-daylight models, looking at the change in the daylight variable from one sample to another and with the addition of the teacher characteristic variables.

We also had one other complexity to account for. In coding the data from the Teacher Survey it was discovered that three schools had been inadvertently dropped from the original study population. Criteria for inclusion of a student's record in the original analysis had included complete records for test scores, attendance and demographic data. We did not observe at the time that we had not been provided with attendance data for three entire schools. Thus, the data cleaning procedures resulted in inadvertently dropping all students (and all teachers) from those three schools from the analysis. We were particularly

concerned since two of the dropped schools represented somewhat extreme daylight conditions, one with many classrooms of *Daylight Code 0*, and the other with many Classrooms of *Daylight Code 4*. Thus, we worried that the exclusion of these schools from the original analysis may have skewed our results.

We noted that any effect due the missing attendance data could be absorbed to some degree by the dummy variable that identified the school site that was missing the attendance information. Thus, we decided to create a new "expanded" population that included these three schools and provided a "missing" indicator in the attendance record fields. This "expanded population" model included 394 teachers and 9200 students, 13% larger than the original study population.

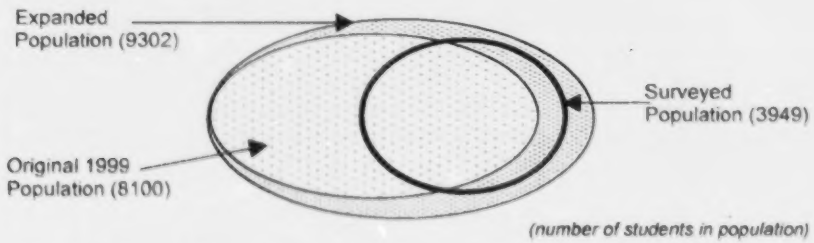

Figure 13: Surveyed, Original, and Expanded Populations

We were interested to see if the daylight variable would remain significant in models of student performance in these different populations, with and without the addition of the teacher characteristic variables. The *teacher survey population* would present the clearest test of the impact of the teacher characteristics, since for this population we would have information about teacher characteristics for 100% of the teachers. The *expanded population* was likely to have the truest daylight results, since it represented the full 2-5 grade district population in 1997/98 school year. For this population we had information on 50% of the teachers.

3.5.1 Findings of Different Study Population Models

Figure 14 and Figure 15 compare the results for the three sets of regression models; the original model, the expanded model, and the teacher surveyed model, for the reading and math models. Full detail of all models is included in the Appendix. In addition to comparing the B coefficient for the *Daylight Code*, the significance of the *Daylight Code* and the R^2 of the model, we also report here on the effective rate of change in the learning rate, and the confidence interval for that rate.

Key	Capistrano Reading Model, Study Population	Teacher Variables Included in Model	B Coefficient for Daylight Code	p (Signif) of B	Model R^2	% Change in Learning Rate	confidence interval
A	original	no	0.464	0.000	0.247	26%	
B	original	yes	0.475	0.000	0.248	27%	
Shift from Model A to B			0.011	no change	0.001	1%	no change
C	expanded	no	0.416	0.000	0.238	24%	
D	expanded	yes	0.418	0.000	0.240	24%	
Shift from Model C to D			0.002	no change	0.002	0%	no change
E	surveyed	no	0.434	0.000	0.239	23%	
F	surveyed	yes	0.463	0.000	0.243	25%	
Shift from Model E to F			0.029	no change	0.004	2%	no change

Figure 14: Daylight Affect for Different Populations, with and without Teacher Variables, on Reading Tests in Capistrano

Key	Capistrano Math Model, Study Population	Teacher Variables Included in Model	B Coefficient for Daylight Code	p (Signif) of B	Model R^2	% Change in Learning Rate	confidence interval
A	original	no	0.504	0.000	0.257	20%	
B	original	yes	0.430	0.000	0.259	17%	
Shift from Model A to B			-0.074	no change	0.002	-3%	1%
C	expanded	no	0.351	0.000	0.250	14%	
D	expanded	yes	0.301	0.000	0.252	12%	
Shift from Model C to D			-0.050	no change	0.002	-2%	no change
E	surveyed	no	0.544	0.000	0.274	21%	
F	surveyed	yes	0.497	0.000	0.277	19%	
Shift from Model E to F			-0.047	no change	0.003	-2%	no change

Figure 15: Daylight Affect for Different Populations, with and without Teacher Variables, on Math Tests in Capistrano

For the reading model, the most conservative estimate of a daylight effect would be +11% for the surveyed population without teacher variables (23%-12%), while the most optimistic would be +37% for both the original and surveyed population with teacher variables (27%+10% and 25%+12% respectively). For the math model, the most conservative estimate of a daylight effect would be +7% for the expanded population with teacher variables (12%-5%), while the most optimistic would be +29% for the surveyed population without teacher variables (27%+10%). Thus, from worst to best case we can say with a high degree of confidence, that children with the most daylighting in Capistrano are learning somewhere from 7% to 37% faster on the District's math and reading curriculum.

With the addition of teacher characteristics to the three sets of models, the following changes were observed:

- Daylight variables were still significant across all models
- R^2 value increased by 0% to +2% indicating that the models with teacher characteristics had a slightly better explanatory power for the studied phenomena.
- Math models indicated a decrease in the effect of daylight on student performance by 2% to 3%.
- Reading models indicated an increase in the effect of daylight on student performance by 0% to 2%.
- In general the availability of daylight in classrooms was reliably associated with an increase in student performance and learning rate of somewhere within the bounds of 7% to 37%. The central tendency among all these models would seem to be a 25% improvement in reading and a 16% improvement in math, or a 21% general improvement between children in classrooms with the most daylight (code 5) compared to those in classrooms with the least (code 0). In summary, if the average student in the district were moved from an average classroom (code 2.5) to a classroom with maximum daylight (code 5), he or she would be expected to increase his or her learning rate by 11% (10.5).
- All these results were observed with 99.9% statistical certainty.

In addition, we were interested to understand the change in daylighting effect among the three populations, the original, expanded, and surveyed, before the addition of the teacher variables. Figure 16 and Figure 17 compare the changes when moving from the original population to the expanded population (13% larger), and from the original to the surveyed (50% smaller) for both reading and math. These changes were also very modest, with from a 3% to 6% shift in the net impact of the daylight variable on student learning rates.

Key	Capistrano Reading Model, Study Population	Teacher Variables Included in Model	B Coefficient for Daylight Code	p (Signif) of B	Model R^2	% Change in Learning Rate	confidence interval
A	original	no	0.464	0.000	0.247	26%	
C	expanded	no	0.416	0.000	0.238	24%	
Shift from Model A to C			-0.047	no change	-0.009	-3%	-1%
A	original	no	0.464	0.000	0.247	26%	
E	surveyed	no	0.434	0.000	0.239	23%	
Shift from Model A to E			-0.030	no change	-0.008	-3%	-2%

Figure 16: Teacher Variables and Daylight effect on Reading for the Three Populations Compared

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Key	Capistrano Math Model, Study Population	Teacher Variables Included in Model	B Coefficient for Daylight Code	p (Signif) of B	Model R^2	% Change in Learning Rate	confidence interval
A	original	no	0.504	0.000	0.257	20%	
C	expanded	no	0.351	0.000	0.250	14%	
Shift from Model A to C			-0.153	no change	-0.007	-6%	-1%
A	original	no	0.504	0.000	0.257	20%	
E	surveyed	no	0.544	0.000	0.274	21%	
Shift from Model A to E			0.040	no change	0.017	1%	2%

Figure 17: Teacher Variables and Daylight effect on Math for the Three Populations Compared

Interestingly, the greatest variability between models, 6%, occurred from the original to expanded populations for the math model. Earlier, in the Classroom Level Analysis, included in the Appendix of the 1999 Detailed Report, we had found much greater variability in the success of math instruction attributable to individual teachers than reading instruction. Thus, we would also expect greater volatility in the math results between population samples.

The following findings were observed when comparing the three populations before adding the teacher variables to them:

- No change in significance of daylight variable
- The explanatory power of the statistical models (i.e., R^2) in explaining the data varies by less than 2%.

3.5.2 Conclusions of Different Study Population Models

The shift in model study populations actually had a greater impact on the R^2 of the models than the addition of the teacher characteristic variables. We also saw the largest shift in the magnitude of the B coefficient for the *Daylight Code* between study populations, rather than with the addition of information about the teachers. Thus, we conclude that the selection of the study population is more likely to impact findings about the effect of daylight than is the addition of information about teachers.

We continue to believe in the importance of the addition of the teachers' characteristics to the model, both to access the potential for a teacher bias and to further refine the accuracy of the model. However, it is clear from this exercise that the study population is likely to have an even greater effect on the results. This once again argues for the importance of replicating the study in other districts, and preferably in widely differing geographic regions and cultural environments.

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4. GRADE LEVEL ANALYSIS

The Grade Level Analysis task was intended to answer two of the questions that were raised from a previous peer review[1] of the Daylighting in Schools study.

One question was whether it was might be more appropriate to analyze the data in single grade cohorts, rather than across grades. It was proposed that especially in Seattle, for the Iowa Test of Basic Skills (ITBS), results could not correctly be compared across grades. Creating separate models for each grade level would solve this problem.

A second question asked whether the daylighting effect might vary by grade level. The models used in the first analysis constrained the results to a simple linear expression. It was argued that there might be a progressive effect, again especially in Seattle, where children were exposed to fairly consistent daylighting conditions for the duration of their career at a given school. In Seattle, where we were looking at absolute test scores, exposure to good daylight conditions over more than one year might result in a cumulative effect. This would be evidenced by a progressively greater daylight effect in each higher grade. Again, separate grade level models would allow the daylight effect to change by grade level, allowing us to identify any patterns as children got older.

In Capistrano, we hypothesized that we would not find any progressive effects since children are likely to be shuffled back and forth between traditional classrooms and portable classrooms with each change in grade level. We confirmed with the District that the churn rate in the Capistrano district is reasonably low, with about 4% growth per year, and a similar number of students who relocate to other districts per year. Thus, we estimate about 90% of the students return to a given school each year. Typically, they would experience at least two, if not three or four daylight conditions throughout their career at a given school. Furthermore, since in Capistrano we were looking at the improvement in schools in one year, from fall to spring, cumulative effects would be less likely to show up.

4.1 Hypothesis

Given the main objective of this task, it was hypothesized that daylighting may have a cumulative effect on student scores. This hypothesis would be likely true if a pattern of progressively stronger effects by grade level was observed in Seattle, where children typically remain under one school-wide daylighting condition. A comparative analysis for the test scores in the Capistrano school district, where students may change between high and low daylighting conditions

[1] Daylighting and Schools Peer Review Report, sent to PG&E, July 21, 1999. Not released.

during their stay at an elementary school, would corroborate our hypothesis if a minor or no cumulative effect of daylight was observed in that district.

4.2 Methodology

We re-ran the student performance regression models for both Seattle and Capistrano, this time allowing the daylighting effect to vary by grade level. This was achieved by adding grade level interaction variables for each variable in the model. This is statistically equivalent to running separate models, but simplifies the reporting and interpretation.

Interaction variables between the grade level of the student and each explanatory variable were created and added to the original Capistrano and Seattle models. As in the original study, the Capistrano model used the difference between fall and spring scores while Seattle's used the absolute value of the spring scores.

Since information regarding teacher characteristics was available for the Capistrano school district, the teacher variables were also included in the Capistrano math and reading models to strengthen their explanatory power.

4.3 Findings

The data from our interaction models did not show a significant effect for the interaction variables between daylight and separate grade levels. This indicates that, for our study populations, we could not support the hypothesis that daylight has a different or cumulative effect on student performance by each grade. The full model results are shown in the Appendix 7.3.

We also found that allowing the results to vary by grade did not improve the accuracy of the models. The R^2 of the models increased only very slightly with the addition of the interaction variables, 4% for the Seattle reading model, and less than 1% for the other three. (See Figure 18 and Figure 19)

It is important to note, however, that the daylighting effects remained highly significant even after the addition of the interactive variables. This indicates that daylight still provides a robust explanation of student performance in math and reading tests across all grades. For the Capistrano reading model, the magnitude of the effect (B) declined by 14%, but not the significance.

For the Capistrano math model, we saw a greater impact on both the magnitude (45% decline) and significance (7% decline). This is the one incidence where the daylight variable would not pass our threshold criteria of 95% significance or greater for inclusion in the model. This decline in significance and magnitude were probably caused most by the addition to this model of the one daylight-grade level interaction variable that did prove significant: *Daylight Code(2nd grade)*. This interaction variable was found to increase the daylight effect considerably for second graders, by more than twice (216%). The interpretation

here would be that second graders in more daylit classrooms were mastering the math curriculum dramatically faster then those who were not in daylit classrooms, and also comparatively faster than children in other grade levels in daylit classrooms.

While this finding about second graders learning math might seem potentially interesting, the fact that we did not find any other significant interaction effects in any of the other model tends to discount the validity of this finding. Out of twelve opportunities, the interaction between grade level and daylight was found to be significant in only one case. Thus, we tend to doubt that there is any differential sensitivity to daylight by grade level.

Key	Test	Interactive Variables	B	Model R^2	% impact	error bound	Signif.
A	Reading	N	0.464	0.247	26%	+/-10%	100.0%
B	Reading	Y	0.396	0.239	22%	+/-9%	100.0%
Shift from Model A to B			-14%	-0.008	-4%		0%
C	Math	N	0.504	0.257	20%	+/-5%	100.0%
D	Math	Y	0.275	0.261	11%	+/-12%	92.7%
Shift from Model C to D			-45%	0.004	-9%		-7%

Figure 18: Capistrano Grade Level Models with Interactive Variables Summary

In Seattle, when allowing for grade level interactions with all the other variables, we saw no declines in significance, and also saw substantial increases in the magnitude of the daylight effect. In the case of the Seattle reading model, the magnitude of the daylight effect increased 26%, while in the math model the magnitude of the daylight effect increased 12%. For the Seattle reading model, the accuracy of the model (R^2) increased 4%. This would tend to argue for the validity of the increase in the magnitude of the daylight effect. Since some of the significant interaction variables have to do with the physical conditions of the classroom (school vintage, school size, classroom SF) it is possible that some of the daylight effect was previously being masked by the imprecision of those variables without the interaction effects.

Key	Test	Interactive Variables	B	Model R^2	% impact	error bound	Signif.
A	Reading	N	1.883	0.297	16%	+/- 8%	100.0%
B	Reading	Y	2.533	0.337	22%	+/- 7%	100.0%
Shift from Model A to B			26%	0.040	6%		0%
C	Math	N	1.391	0.258	12%	+/- 7%	99.9%
D	Math	Y	1.585	0.257	13%	+/- 7%	100.0%
Shift from Model C to D			12%	-0.001	2%		0%

Figure 19- Seattle Grade Level Models with Interactive Variables Summary

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4.4 Conclusions

The grade level analysis did not increase the accuracy of the models. Further more, while we did find interaction effects between grade level and other variables, most notably the demographic variables, we did not find a consistent interaction between grade level and a daylighting effect. This was true in both Seattle and Capistrano.

From this exercise, we conclude that our original modeling approach, grouping all of the data for grades 2-5, was sufficiently accurate. We also note that we did not find any progressive effect for the daylighting variable, as postulated for Seattle, nor any other pattern related to the age of the student.

5. ABSENTEEISM ANALYSIS

The Capistrano data set includes information on absences and tardiness per student. Both of these parameters were included as explanatory variables in our original daylighting analysis, but not as dependant variables. We did not use them as dependant variables at the time for two reasons. First, we did not have this information for all three districts, and our original criteria included consistent analysis across districts. Second, the absenteeism and tardiness data is much thinner than student test performance data, since only about 10% of students had a significant number of absences. Thus, it provided a much less sensitive metric of performance.

However recent research findings by others, discussed below, suggested that we should re-examine the Capistrano data set for similar effects. In a number of studies increased ventilation rates have been found to reduce worker absenteeism. There has also been increased interest in the effect of classroom environments, particularly portable classrooms, on student health with a number of epidemiological studies initiated to look for these links. Finally, many daylighting proponents have been claiming the daylighting improves student attendance, and thereby will also increase funding to the schools through California's system of ADA (average daily attendance) payments.

Milton et al of Harvard School of Public Health reported that increased ventilation rates were associated with reductions in sick leave in the Polaroid Company offices in Massachusetts[1]. They report: "Based on this latter analysis, 45% of the sick leave among workers in lower ventilation areas was attributable to lower outdoor air supply. Similarly, 41% of sick leave was [also] attributable to humidification, and 39.2% of sick leave...was attributable to the presence of (IAQ) complaints. This corresponded to 1.4 – 1.5 days of increased sick leave per person per year attributable to ventilation, and 1.2 – 1.3 days per person per year attributable to humidification, and 1.1 – 1.2 days per person per year attributable to IAQ complaints, depending on age and gender."

Teculescu et al. [2] recently reported that occupants of an air-conditioned building were more likely to have multiple absences from work than were persons in a naturally ventilated building. This study was limited, however, by the use of only two buildings (in northeastern France), and by lack of control for ventilation rates and individual and group factors that may have confounded the relationship between building and sick leave.

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[1] Milton DK, Glencross PM,Walters MD. Risk of Sick Leave Associated with Outdoor Ventilation Level, Humidification, and Building Related Complaints. Harvard School of Public Health, August 1999

[2] Teculescu DB, Sauleau EA, Massin N, Bohadana AB, Buhler O, Benamghar L, Mur JM. Sick-building symptoms in office workers in northeastern France: a pilot study. Int Arch Occup Environ Health 1998; 71:353-6.

The interest in the effect of classroom construction and maintenance, particularly portable classrooms, on student health has peaked in recent years. Current projects in progress include: HP-Woods Institute is studying the relationships between indoor environment and occupant performance in two elementary schools, funded by Air Conditioning and Refrigeration Technology Institute's 21-CR program; the California Department of Public Health is beginning a study of the environmental health conditions in portable classrooms, funded by Air Research Board; a pilot study of indoor air quality in portable classrooms is being done in Los Angles Count, funded by US EPA; another CEC PIER project is also looking at exposure to VOCs and thermal comfort in four new portable classrooms.

Given this level of interest, we concluded that it would be worthwhile to see if our original Capistrano data set would allow us to make any correlations between classroom physical conditions and student health. The absenteeism and tardiness data could be used as a proxy measure of student health, while daylighting, operable windows, air conditioning, age of classroom and type of classroom (portable, modular, open, semi-open, traditional) could be used as explanatory variables.

We choose to look at absences or tardies data as a reasonable potential proxy for student health. However, our study could not distinguish reasons for absences or tardies. There are many other powerful factors influencing elementary school attendance besides the health of the student, such as dentist or orthodontist appointments, outside activities, poor transportation, parental health, family obligations, etc. Thus, our absenteeism and tardiness variables cannot be interpreted as a strong metric of student health, but rather simply as the best proxy for student health that we had available in our data set.

5.1 Hypothesis

In our earlier Capistrano study, we found that daylight was consistently associated with enhanced learning rates, and operable windows were associated (>95% certainty) with enhanced learning rates in three of the four models. In that original analysis, neither portable classrooms nor the presence or type of air conditioning had a statistically significant effect.

Based on this finding we hypothesized that daylighting and operable windows might also be associated with a reduction in student absenteeism and tardiness in the Capistrano school district.

If this hypothesis were true, operable windows and daylight, as explanatory variables, would appear to be significant and negative in a regression analysis with student absenteeism and tardiness as dependant variables.

Since the models also included other descriptions of the physical conditions of classrooms, we could simultaneously test for the significance of those variables in relationship to absenteeism or tardiness. We were particularly interested in the portable classroom (port) and modular classroom (pport) variables. If

portable or modular construction does indeed impact student health, then we would expect to see these variables show up as significant in the regression analysis.

5.2 Methodology

A multivariate regression model, using the original data from the 1999 study of the Capistrano school district with all the school data, including daylight, operable windows, as well as the addition of the new teacher and school variables, was run. The student characteristics, teacher characteristics, and school and classroom characteristics were run as independent exploratory variables against absenteeism data the dependant outcome variable. A similar model was run with the same variables against tardy data as an outcome variable.

The data set was redefined to include all those students who attended at least 40 days at the same school. The students, however, were not required to have test scores. As a result, the population shifted slightly, including more students who were not present for either the fall or spring tests, but excluding any records missing attendance data. Thus, the three schools from which we had never received attendance data were dropped from the population. The resulting analysis population was 8808 students.

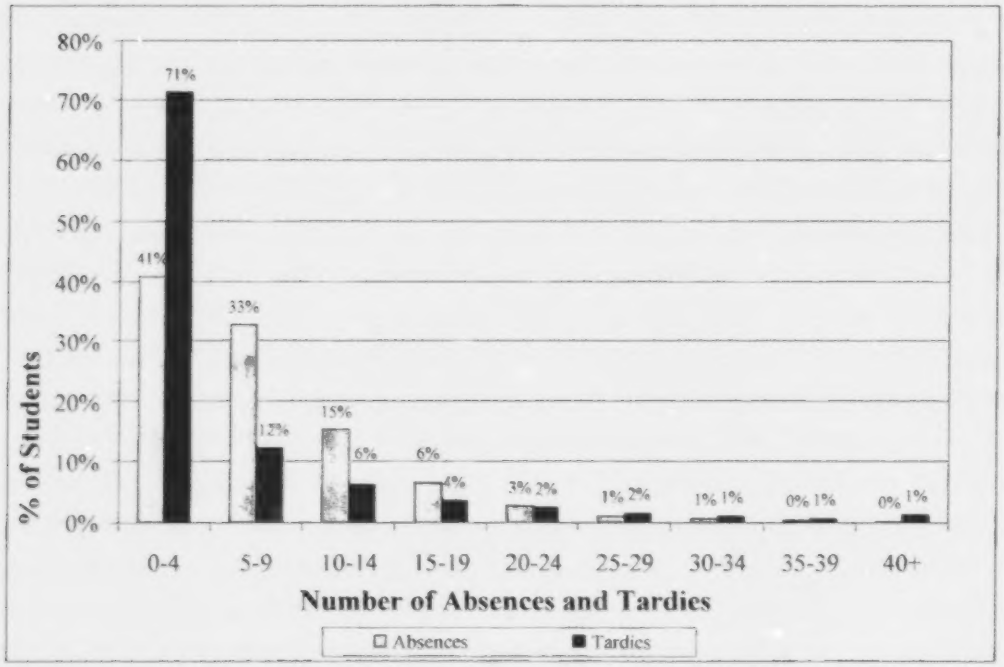

Figure 20- Distribution of Absences and Tardies

The absence variable was defined as a function of the sum of three fields in our data set: unverified absences, excused absences, and unexcused absences.

Absences due to school function were not included. Only the sum of absences per student was available. We did not have information on the distribution of absences over time.

Plotting the attendance data in Figure 20 we noted a very strong curve, where 74% of the population were found to have both fewer than 10 absences, and 83% fewer than 10 tardies. In order to properly model this data distribution we choose to use a natural log function, as expressed in the equation shown in Figure 21 below. We normalized the absenteeism and tardiness data across the whole population by adding a ratio of days enrolled to maximum possible days enrolled:

$$\text{Ln_Abs} = \ln\left[\frac{180\ (\text{maximum of enrolled days})}{\text{number of days enrolled (minimum = 40)}} \times \text{number of Absences (or Tardies)}\right]$$

Figure 21- Equation for natural log of attendance data

5.3 Findings

The regression models with the log of absences or tardiness as dependant variables did NOT support the hypothesis that daylight variables, or any other physical characteristics of the classrooms, have a significant effect on student absenteeism or tardiness.

While these models included all of the same explanatory variables used in previous analysis, they proved to be comparatively weak models. The R^2 of the absences model was only 0.05, and that of the tardiness model 0.10, indicating that only 5% and 10% respectively of the variance in the data was explained by all of the variables included in the models.

5.3.1 Absenteeism Findings

Physical classroom variables that were considered and found to have NO significance in the absenteeism model included: daylight code, operable window, type of classroom (portable, open, traditional), air conditioning, and size of classroom. In addition, none of the teacher characteristics were found to be significant.

Variables that were significant included: grade level, student socio-economic characteristics, special programs, school site, school vintage, and school population.

Thus, we conclude that student demographic characteristics and school level characteristics (which might include neighborhood effects, special programs, or size of school) have the greatest relationship to student absenteeism.

5.3.2 Tardiness Findings

The Tardiness model did find that three physical characteristics of classrooms had a slight, significant effect on the pattern of tardiness:

Daylighting had a modest, positive effect p=.000

5% reduction

No Air Conditioning had a slight, negative effect p=.032

11% increase

Portable classrooms had a slight, negative effect p=.037

5% increase

$R^2 = 0.097$

These results could be interpreted to predict that the students in the most daylit classrooms would be likely to have one less tardy per year than those in the least daylight classrooms (5 daylight codes *.05 per code =25% reduction in norm of 5 tardies per year, or 4 tardies per year.) Likewise, no air conditioning was found to be associated with a slight increase in tardiness, 11% from the norm of 5 to 5.5 tardies per year, and portable classrooms were found to be associated with a slight increase in tardiness by 5%, up to 5.25 tardies per year. .

Since tardies are a somewhat subjective measure of student performance (not all teachers mark a student tardy at the same point of lateness) and since tardies do not have as a strong economic tie to the performance of the school as does absenteeism data, we chose to discount these results as not particularly interesting.

5.4 Conclusions

Student attendance, as measured by absences and tardies, was not predicted by with the daylight conditions of the classrooms in the Capistrano Unified School District. Likewise, other physical conditions of the classrooms were not found to be reliable predictors of student attendance.

From this exercise, we concluded that attendance data is a very difficult outcome metric to work in trying to understand the effects of the physical environment on the performance of students, or the productivity of people in general. There are two basic reasons for this difficulty. First, attendance data can only be a loose proxy for the health of the student, since so many other events can cause a student to be absent or tardy besides health effects caused by the physical environment. Secondly, it is not a very sensitive metric. There is not a very big range in attendance values among students, with only about 10% of the student population showing much variation in number of days absent or tardy.

A summary of the findings from the absenteeism analysis is as follows:

- Daylighting variables were not significant indicators of Absenteeism. Similarly neither operable windows nor portable classrooms variables were significant.
- Student demographic variables were the only reliable predictors of absenteeism
- Physical characteristics of classrooms were not predictors of student attendance
- Attendance data is not particularly useful as a performance metric, providing meaningful variation for only 10% of students in our fairly large samples (n= ~ 8800).
- A slight effect of daylight on student tardiness was observed, but not considered interesting.

5.5 Discussion

Our study could not distinguish reasons for absences or tardies. It was assumed that overall absence and tardy data might serve as a reasonable proxy for student health. However, there are many other powerful factors influencing elementary school attendance besides the health of the student, such as dentist or orthodontist appointments, outside activities, poor transportation, parental health, family obligations, etc. Thus, our absenteeism and tardiness variables cannot be interpreted as a strong metric of student health, but rather simply as the best proxy for student health that we had available in our data set.

Improved physical conditions in a workplace or school have been postulated by many to be associated with reduced absenteeism. Indeed, this is a fairly common assertion made in presentations advocating "green" or "sustainable" buildings—that an improvement in the quality of the physical environment will result in fewer absences and thus higher productivity. These claims are most frequently made for improvements in indoor air quality (IAQ)[1], but also variously for natural ventilation, ventilation rates[2], thermal comfort, ergonomic furniture, electric lighting quality and the presence of daylight.

Our study can only speak to a few of these issues: the potential link between poor indoor air quality in portable classrooms and increased absenteeism. It is important to note that this re-analysis study of the Capistrano data did not substantiate any of these claims.

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[1] Fisk WJ (2000). Health and productivity gains from better indoor environments and their relationship with building energy efficiency. Annual Review of Energy and the Environment 25(1): pp. 537-566

[2] Milton DK, Glencross PM, Walters MD (2000). Risk of sick leave associated with outdoor ventilation level, humidification, and building related complaints. Indoor Air, 10(4): pp. 212-21

Portable classrooms are currently under investigation by a number of researchers for poor indoor air quality[1], which might reduce overall student health.

Our study did not find that there was any significant association between portable classrooms and increased absenteeism among students.

Operable windows have been associated with a reduction in indoor air quality complaints[2].

We did not find that operable windows were significantly associated with any improvement in attendance among elementary school students.

Claims have been made that daylit schools are associated with improved attendance among students[3].

We did not find that increased daylight in classrooms was associated with better attendance.

[1] Per Jed Waldman, CA Department of Public Health

[2] MP Callahan, DS Parker, WL Dutton, and JER McLlvaine, 1997. "Energy Efficiency for Florida Educational Facilities: the 1996 Energy Survey of Florida Schools." FSEC-CR-951-97, Florida Solar Energy Center, Cocoa, Fl.

[3] M Nicklas and G Bailey, "Analysis of the Performance of Students in Daylit Schools," Proceedings of the American Solar Energy Society, 1997.

6. RE-ANALYSIS CONCLUSIONS

6.1 Grade Level Analysis

The data did not show a significant effect for the interaction variables between daylight and separate grade levels. Likewise, we did not observe any consistent patterns of an increase or decrease in daylight effects by grade level. Thus, we conclude that there do not seem to be progressive effects as children get older, nor do younger children seem to be more sensitive to daylight than older children.

Allowing the results to vary by grade did not improve the accuracy of the models; with one exception, the R^2 of the models increased less than 1%. Therefore, we believe that the extra analysis did not add significantly to our understanding and future research can proceed looking at data across grade levels.

Furthermore, the daylighting effects remained highly significant even after the addition of the interactive variables. This indicates that the *Daylight Code* still provides a robust explanation of student performance in math and reading tests across all grades.

6.2 Absenteeism Analysis

The student attendance record regression models did not support the hypothesis that daylight variables or any other physical characteristics of the classrooms have a significant effect on student absenteeism or tardiness. Notably, daylighting conditions, operable windows, and air conditioning were not significant in predicting absences. The models were comparatively weak; the full set of 57 variables for the Capistrano data explained only 5% and 10% of the variance in absences and tardies, respectively.

We chose to look at absences and tardiness data as the best proxy for student health that we had available. Absenteeism and tardiness cannot be interpreted as a strong metric of student health, since many other powerful factors influence elementary school attendance. However, to the extent that attendance data does reflect student health, our study may indicate only a weak connection between physical classroom characteristics and student health.

6.3 Teacher Survey

Although the Teacher Survey task was primarily aimed at providing additional information for other Re-analysis tasks, we did learn some useful information about teacher preferences, attitudes and behaviors. For example, while the teachers we surveyed clearly had a preference for windows, daylight and views in their classrooms, these preferences were not likely to be driving classroom

selection. Far more important in classroom selection was an almost universal desire for large classrooms, lots of storage and water supply in the classroom.

Environmental control is also an important issue for teachers, especially when they find that they don't have it in their classroom. Teachers seemed to hold a basic expectation that they would be able to control light levels, sun penetration, acoustic conditions, temperature and ventilation in their classrooms. When control of one or more of these environmental conditions was not available to them in the classroom, they were passionate and outspoken in their outrage.

We also found that teachers reported using their optional control features frequently enough to make significant impacts on classroom energy use. Use of these features by a dedicated minority would seem to be sufficient to justify their cost effectiveness in terms of energy savings. Of course, their value should also be considered in terms of classroom comfort and productivity.

In their freely offered comments, the teachers were desperate to be heard about the need for better physical environments in their classrooms. It is worth taking the time to review these comments included in the Appendix. Class-size reduction, in particular, has been responsible for many of their current challenges. The teachers clearly resent the many inconveniences posed by sub-optimal classrooms. Capistrano is a well-managed school district with many beautiful new facilities, a mild climate and a world-class location on the Southern California coast. Imagine what kind of responses might come from a district facing far more extreme physical challenges!

6.4 Bias Analysis

We did find that a few types of teachers, those with more experience or honors, were slightly more likely (1% to 5%) to be assigned to classrooms with larger window areas, skylights or operable windows. However, a full multivariate regression of teacher characteristics against the *Daylight Code* found that none of the teacher characteristics that we identified were significant in explaining assignment to daylit classrooms. This model explained only 1% of the variation in assignment to daylit classroom. We concluded that this assignment bias, while it does exist, is extremely small.

Similarly, we found that the daylight variables remained highly significant in the student performance models, even after the addition of information about the teachers. While a few teacher characteristics did show up as significant variables in our models of student performance, the daylight variables remained extremely robust in all models.

Comparing across twelve different models of student performance in Capistrano, we conclude that the central tendency is for a 21% increase in learning rate between children in classrooms with minimal daylight compared to those with maximum daylight.

6.5 Re-Analysis Report

Overall, the strength of the daylight variable in predicting student performance stands out sharply across all of these re-analysis efforts. The addition of more information to the models did very little to change the predicted impact of the *Daylight Code* on student performance.

Only the exercise to link the *Daylight Code* to student attendance was unsuccessful. This is also an extremely important finding, since it contradicts so many claims have been made about the health effects of daylight or other indoor environmental conditions, as reflected in absenteeism rates of building occupants. In this study, in this school district, we did not find that any of the physical attributes that we had available to us to classify the classrooms could be linked significantly with student attendance.

It is also very clear from these efforts, as we re-analyzed the original data sets with additional information, that the findings of these models are much more strongly dependant upon the particular population studied in the analysis than upon the subtleties of all the variables included in the models. Thus, we conclude that it will be much more informative to try to replicate this study with a completely different population, at a different school district, such as we will attempt to do in Task 2.4 of this project, than it would be to continue to try to refine the models and with further detail in the explanatory variables. This process has been informative as a sensitivity analysis and methodological study. We look forward to applying these lessons in the next study.

7. APPENDICES

7.1 Statistical Terminology

The following briefly describes key statistical terms in the report.

Table 1

Term	Name	Definition
r	Correlation Coefficient *Or* Pearson correlation	Measures the strength of the linear relationship between two variables It can take on the values from -1.0 to 1.0, where -1.0 is a perfect negative (inverse) correlation, 0.0 is no correlation, and 1.0 is a perfect positive correlation. On page 6, r is the correlation between well-qualified teachers, and student performances. When .61<r<.80, a strong positive relationship is predicted.
p	p-value	A p-value is a measure of how much evidence you have against the null hypothesis, i.e. that the hypothesis is not true. (In the report on page 6, the null hypothesis could be interpreted as: r=0). The smaller the p-value, the more evidence you have. (On page 6, a very small p-value indicates that one has very high evidence that the given correlation is significantly different from 0). The probability of a false rejection of the null hypothesis in a statistical test is called the significance level. A p-value can vary from >.00 to <1.0. The significance level is 1-p, expressed as a percentage. So if a p-value is .01, the significance level is 99%. One may combine the p-value with the significance level to make a decision on a given test of hypothesis. In such a case, if the p-value is less than some threshold (usually .05, sometimes a bit larger like 0.1 or a bit smaller like .01) then you reject the null hypothesis.

Term	Name	Definition
R^2	Regression correlation coefficient	A value between 0 – 1.0 that indicates how well an X value (or the independent or explanatory variables in the regression) explains a Y value (the dependent variable). Technically, the regression equation is: $Y= B_0+B_1X_1+ B_2X_2+...+ B_nX_n+e$ where B_0= intercept, e=error, so as Xs change, Y, the dependent variable, also changes., and variations in X values cause variations in Y. R^2 is defined as the percentage of total variation in Y explained by the independent variables. If R^2 is equal to 1, then entire variation in Y is explained by the independent variables, i.e. the model is very good, and the X variables have perfect explanatory power (for explaining Y). So, the higher the value of R^2, the better the model is for that set of data. Models explaining data that have a high degree of inherent variation, such as individual behavior, will have a much lower R^2 than models explaining more predictable events, such as group averages.
B	B Coefficient	Technically, the regression equation is: $Y= B_0+B_1X_1+ B_2X_2+...+ B_nX_n+e$ where B_0 is the intercept (constant), and $B_1, B_2, ..., B_n$ are the slopes of the regression equation, or the coefficients of the Xs, (or the independent variables), and e is error. A particular B_i (i=1,2,...,n) shows how a particular X_i variable is related to Y. If a B_i coefficient is a positive number, an increase in X_i by one unit increases Y by the amount of the B_i coefficient. Please refer to Figure 11 for a list of the B coefficients for each independent variable.

7.2 Teacher Survey

(format changed slightly to fit two pages in this appendix

CLASSROOM SURVEY

Dear CUSD Teacher,

The Heschong Mahone Group, an architectural consulting firm, has been working with the Capistrano Unified School District on an innovative study of the relationship of the physical classroom environment and student performance. We have been funded by the California Energy Commission to do a follow up study to examine a few methodological questions. To do this, we need your assistance to collect information about CUSD teachers and their classrooms.

Please fill out this brief two-page questionnaire and return it today. All individual responses will remain strictly confidential, and will not be released to the District, or to anyone outside of our immediate research team. Only summary data will be reported.

Thank you for your help!

Lisa Heschong, Partner, Heschong Mahone Group

A. Please tell us about yourself:

1. Your Name _____ Grade Level: _____
2. Your current room number (location): _____ 99/00 School: _____
3. How many years have you been in this classroom? _____

(answer questions 4 and 5 below if you have moved your classroom in the past three years)

4. Your room number from **2** years ago (97/98): _____ Grade Level: _____
5. How many years in that **(97/98)** classroom? _____ 97/98 School: _____

6. How many years have you been teaching at this **school**? _____
7. How many years have you been teaching in this **district**? _____
8. How many years have you been teaching **total**? _____

9. Your Gender: Male o Female o
10. Your Age: 20-39 o 40-59 o 60+ o

11. Your College Degrees: _____
12. Additional Coursework: _____

_____

13. Teaching Awards: _____

B. Please tell us about your classroom:

14. Do you feel that you had any influence on the selection of your classroom location?

This past year:	Yes	o	No	o	Maybe/not sure	o
When I first started here:	Yes	o	No	o	Maybe/not sure	o
Anytime in between:	Yes	o	No	o	Maybe/not sure	o

15. If you *could* select your own classroom, what would be the three most important criteria you would use to choose? If possible, put them in rank order (1,2,3)

_____

_____

_____

16. Do you prefer teaching in a permanent or portable classroom?

Permanent classroom: o Portable classroom: o No opinion: o

Why? _____

17. In general, while school is in session, how often do you:

		Never					Always
*(*Please use the scale described below:)*	**N/A**	**0**	**1***	**2***	**3***	**4***	**5**
Open a window for ventilation	o	o	o	o	o	o	o
Open a door for ventilation	o	o	o	o	o	o	o
Close a door or window to reduce noise	o	o	o	o	o	o	o
Turn on a portable fan	o	o	o	o	o	o	o
Adjust the thermostat	o	o	o	o	o	o	o
Teach with the curtains or blinds closed	o	o	o	o	o	o	o
Teach with all the electric lights off	o	o	o	o	o	o	o
Teach with some of the lights off	o	o	o	o	o	o	o
Darken the room for TV or computer use	o	o	o	o	o	o	o
Do something in order to block the sun	o	o	o	o	o	o	o

N/A This is not possible in my current classroom

0. I could do this in my room, but I never do
1. I do this occasionally, a few days a year
2. I do this often, more than 10 times per year, depending on the weather
3. I do this often, more than 10 times per year, independent of the weather
4. I do this very frequently, about once a week or more, all year
5. I do this about once a day or more, all year

18. Any comments?

_____

_____

Thank you very much for your time!
If you have any questions about this survey, please contact Lisa Heschong at the address below.

7.2.1 Three Most Important Criteria in Selection of Classroom

(Answers to Question 15)

fresh paint
location
matching/appropriate furniture

my own 4 walls
water in classroom
more storage

Heating/ventilation/air conditioning
natural light
sound proofing

Quiet
room and light
storage space

walls to separate from other rooms
air conditioning/heater
noise level-

air conditioning
clean air
proximity to facilities (bathroom, cafeteria)

a door that closes
full size walls
equitable room size

brightness/airflow/lighting
size
available water

A good location, off the street and parking lot
Enough room
ventilation, temperature control (see notes)

In main building
air conditioning that works quietly
close proximity to restrooms

quiet
your are in control of noise level
limited distractions i.e. window

windows for natural ventilation and lighting.
bulletin boards,
access to water

Access to water
a 2nd window for cross ventilation/light
sufficient storage

Size
sink
windows

permanent classroom
located near grade level team
noise

size
water in classroom
storage for supplies

in the building
light
new

Inside school
close to team
close to playground access
4.away from noise

in the building
away from the lunch area
in the same pod as the grade level I'm teaching

quality health standards i.e. no asbestos
safety close proximity to school
sink

size
location in school
storage space

quiet
spacious
close to supplies

quiet environment not near the lunch area
good lighting
good ventilation, air circulation

enough space and storage
inside where the main bldg. Provides water, sinks and
center work area
easier computer printer access and classrooms are
better maintained

size
storage boards and white boards/bulletin boards, 4
cleanliness

How large is the room
Is it clean and safe
Does it have communication to 911 or office staff

Proximity to MPR for music activities I do
ventilation - airflow (catches prevailing breeze
size and brightness (windows and skylights

larger in size
keep playground noise to minimum
storage

Adequate lighting
ventilation of fresh air into classroom
room size

sink-washing hands -
science, art
white boards to eliminate dust -

safe/noise
size
water

phone
air conditioned
sink

size
air
storage

close to office
full view of street for safety during weekends
near bathrooms

size,
location
who neighbor teachers are

Working air conditioner
Big room
water

size
location
quality of ac

more, much more room. My current room has no room, it is a misnomer
cupboards that opened more than a 30 degree acute angle
built-in shelves attached to freestanding walls

location
has windows
size

size
storage
noise level

size
location, proximity to same grade teachers, playground, office
shape

square footage (storage, too)
quiet
access to water, elect. Etc. no water in my portable

quiet surroundings
windows, yet not looking out onto playground
sink with water

location
size
noise level

permanent classroom-completely enclosed
permanent classroom with minimal noise from neighbors
portable with adequate ventilation

Quietness
space
near bathroom

light-windows
sink
noise level quiet

size
cupboards for storage
location

size
noise level
window

Large room(space for desks, floor space & small group space
single desks (not large tables or trapezoids
sink and storage area

quiet
sink
larger size

cabinets
sink
room size

4 closed walls
large
windows

Balanced - behavior
academic abilities and
study skills

quiet (solid walls
sink
built-in shelves

light-natural
outside door
size/space

outside door
sink
built in cupboards

student friendly
ample room
location

large
quiet
good a/c

size
window
outdoor passage

self contained
adequate space

self contained classroom /4 walls doors and quiet
an air conditioner that works
larger room to allow for centers

space, present size
windows tinted
storage space closed off by moving white boards

open windows, light
quiet, insulation from other rooms
nearby work room/office

with grade level
windows
access to bathrooms

Windows that open (big windows)
good storage space
carpet

space-lighting
storage
clean carpeting and freshly painted room

size(permanent room with sink)
location(away from playground noise)
windows and natural lighting

away from playground noise
size
near grade level

space (usable)
freshness (clean painted)
location(proximity to playground, office

location
size
age

size
cleanliness
location(near office, restrooms

Size, room to move & do centers
location
water, storage

Large enough for desks and room for center grouping
sink
ample cabinets and drawers for books and supplies

Lots of natural light, windows, skylights
space for kids & materials
grade levels clustered together

windows
source of water
view

close to other teachers at my grade level
close to office/work room
noise level

windows
phone
water

space
light
noise location

next to other second grades
facing courtyard
close to office

location - away from playgrounds and lunch tables
exterior view- students need to work outside at times

Enclosed room
room to move around/nice big space
sound proof

location near someone I can team
quiet location - grass, trees, etc
full size-running water

size
air and water
storage

air conditioning and heating system that works
windows-

available water
outside door/window
space

windows
sink
space

outside access
space
sink area

windows
door to outside
air conditioning

location
size
facilities (sink, etc)

size
noise level
close access to library, computer room, etc

air conditioning
light
spaciousness

size- and storage
location in respect to playground bathrooms
location in regards to other grade level classes for learning

climate control
access to a bathroom
water in room

location to playground
restrooms
office

single desks to lend for flexibility
carpet for sound
tackable wall space

natural light - windows
openness- size
lots of useable/tackable walls

quiet
windows/light(natural)
size

windows
built in cupboard space
sink/space for students to walk around

windows
sinks
space lots of it

Windows, natural light and a view
self-contained and not in the traffic pattern so we're not interrupted frequently
adequate air conditioning and heating

away from recess area
close enough to workroom, office, library
size though all are the same

Little outside noise, I am next to preschool special ed play yard
fresh air
room to move freely and for storage

quiet area
close to team teacher
black top and ramp area not in field

size
proximity to front of school
no paneled walls

Black/wipe boards
sink
storage

close to teammates
away from playground
privacy

enclosed (4 walls
close to office or work areas
away from playground

controlled air circulation
windows and door access
physical space

closed in classroom
newer facility
location relative to team teachers

size
doors
location to office

self contained, no open walls
roominess
fully equipped, water, phones, etc

closed classroom
air conditioner that doesn't leave dirt throughout room

wall that can be stapled into

closed - self-contained
lots of bulletin boards and magnetic white boards
control of heat/air

size
location

ability to isolate class and students from surrounding noises and other students and other instructions
to control temperature and air flow
proximity to team mates of same grade,
if any choice was available more modern facilities including storage and water /sink

size
lighting
storage

quiet
accessible
well ventilated

Enough space for children & furniture (not crammed together)
cupboard space, built in drawers, sink in room, counters
windows

noise (exterior)
temperature
lighting

two exits
running water
windows that open

size
storage
lighting

size
location away from outside noise, i.e. freeway, lunch area
storage space

space of students, desks, materials
storage
easy access to playground

space floor space wall space
physical environment ventilation, lighting etc
location, restrooms, drinking fountains

corner room with minimal 'traffic' flow
storage space and inside sink
white board space

windows
storage/cupboards
size/bright/clean/well ventilated

size
natural light
self-contained

away from playground
near bathroom
near office

lots of space
lots of bulletin boards
lots of storage room

size fits 30
windows to the outside
self-contained

space size of classroom and storage space
windows
location

easy accessibility
more built-in bookshelves and counter, cabbies
larger wet area

space for children
sink area
storage space

not too close to a playground
not too close to an eating area
a room with windows that can be opened
4. better lighting

white boards
storage
space

distance from playground
access to pod

space
storage
layout

size
technology wiring
sink

clean new facility
appropriate lighting
nice size

windows. my classroom at Moulton had none
space to move around the room
sinks with clean running water

size
ventilation
sinks in classroom

sink,
sunlight
location

size
lighting,
windows

a classroom with much more light
new carpet

Inside bathroom and sink
art area

enough closet space/cubbies for minimum # of children
water
windows

away from playground noise
have air conditioning
plenty of room

windows that open
built in storage space
thermostat controlled inside temps

space
window/walls
storage

size
location in relation to playground/office
location in relation to others at same grade level

size
storage ac/heat ventilation

windows
running water
built in storage

air conditioning
size
water

space for all students/desks/cupboards
lighting in class
soft walls to hang things

size
running water/sink
condition of classroom

size
light
locations

size
windows
location

student space
storage
location (away from playground etc)

size
wall space
proximity

Lots of space
lots of natural light
adjoins other rooms

windows
space - bigger than a portable
cabinet/storage areas

In the school building
Water
Connected to a pod

storage
windows
sink

location close to same grade level
size
storage space

permanent classroom
quiet location
convenient location

size
location -

size
clustered w/other 5 grades
away from playground distractions

location
space/cabinets
room (sq. footage)

space
light
storage space

physical space
storage
light

Access to natural light (window thick walls so
my students may work noisily at times
cabinet space/technology

3 Pod-
close to office
teaming situation

student work space
materials storage
water

main building
with grade level
work room

storage
location/workroom
windows

Quiet (we have open classrooms
windows to the outside to see out
large enough for desks and centers

space
doors
windows

sink
size
windows

light
compatible teaching style-neighbors
easy accessibility in and out

windows and natural light
good lighting (electrical
ample size

natural light
ventilation
secluded location not central because of foot traffic

portable
room with a window or outside lighting
my own air conditioning controls

enclosed
lots of space
lots of storage space

walls and door
windows
water

centrally located
storage furniture

Built in sink
close to bathroom
close to the "going ons" with the school

Location away from playground noise
inside main building
near team (grade level)

close to bathroom
size
inside the building

large size
good location-close to copiers, etc
clean

close to another room incase I need another teacher to keep an eye on my class or vice versa
work area in central pod and area for storage
proximity to copiers

size
noise factor
location to main services

room size
access to water pod area

size
building vs. portable
location

space per student
technology
environment (sink, water a/c etc

space
windows(light)
wallspace (allowing for displays and bulletins

Interior environment (cleanliness etc)
location (in the school near office, copiers, etc)
storage

size
location
storage

location to office, bathrooms etc
running water
size of room

size
location, front of school, avoid playground
lighting

size
location
storage space

air conditioning
more cupboards
new carpet/paint

large enough
desks in good condition
natural light

location - near grade level
air conditioning
storage

Full size classroom
air conditioning
sink/water in classroom

permanent classroom - large
bulletin board type walls to ceilings
square room (unlike bowling alley I am in

air quality (windows, proper ventilation etc
size not a bowling alley as it is now 2 portables divided into 3
not a portable

size
air conditioning
condition/cleanliness

size
quality - carpet-paint
air from window flow, very important

windows
water in the classroom
size

space available ventilation
room environment/sink, painted walls in good condition etc

good ventilation
quiet location
lighting

Internet/electrical/av wiring
windows-light
size

size
location
condition

large room
windows that open/close
bulletin board space

away from the black top room overlooking courtyard or grass area
carpeting to the door

size
location
storage space

space
location
light

appropriate space for the number of students and furniture that will occupy it
Adequate storage for student and teacher resources
condition - everything clean and in working order

size for 33 students
heating/ac
sink & water to drink

sink
air conditioner/heater
spare cupboards

sink, access to water
air conditioning
location to playground (far enough to not be bothered by noise, close enough so it is not a 10 min hike

conveniently located
size
a/c and heating

size - larger the better
Location in school "noise factor"
amount of storage and air conditioning

windows - open-ness
light (not dark)
designed - physical lay-out in harmony for centers/teaching

Storage, there needs to be some
water
windows, fresh air

windows
non toxic
air circulation

In the school building closer to restrooms, labs, workrooms
running water for science, art, hygiene
space and storage; less noise

Near teammates
in the bldg. W/water, near office and restroom
not used after school

Location
surrounding noise
appearance

Floor space
outside noise level
storage

Adequate floor space with super storage including book shelves quiet environment away from lunch and recess noise windows providing natural light

Quiet location
bright
storage

Size (30+ fifth graders need lots of room
location (I'm in what we call cell block B)
windows, (I have one small window makes me feel claustrophobic and lack of natural light is depressing

size
being in main building

location
amount storage space
windows

easy access location to office and spots that will help w/my student council advisor position
quietness
window/door placement and room design

bulletin board space (sufficient)
storage, ample
sink in room, bathroom and work room closer

air conditioning
size
in main building (not portable

proximity to office, restrooms, workrooms, lounge area,
running water
proximity to grade level team members
area with maximum sunlight, minimum playground noise

cleanliness
temperature
classroom relationship to office

sink w/water fountain
amount of space, at least 30' x 30'
window or skylight, door to the outside

size
storage
running water

size
location
lay-out

space
windows
storage

size
storage
cleanliness/brightness

windows that open
not near the playground noise
more natural light

Size
Windows for air
clean

be closer to the office
larger classroom
fresh air flow, open window on one side and the door on the other

7.2.2 Permanent v. Portable Classrooms

Answers to Question 16

Preference	Why
depends	depends on factors in question 19
depends	it depends, if the perm classroom is large and quiet, I prefer perm. If not portable
depends	both have positives, permanent rooms have better equipment and sinks, portables seem more private but are uglier on a campus
no opinion	17 times, no comments
no opinion	as long as it is large enough for centers
no opinion	both have +/- portable + air - no water and more wall space, permanent no air water more windows
no opinion	either is fine, as long as there are walls
no opinion	either is good with above options
no opinion	haven't tried a portable
no opinion	I don't care so long as top 3 choices are met
no opinion	I have had both and can adjust to either
no opinion	I have taught in both, and as long as they are new and nice esp. portables they are great
no opinion	I love portable walls, staple everything up
no opinion	If the portable had running water and was large it wouldn't matter
no opinion	I've done both they are both fine
no opinion	I've never been in a portable
no opinion	I've never taught in a portable classroom so I have nothing to compare
no opinion	I've only taught in portables
no opinion	never taught in permanent but I'd like water
no opinion	permanent have storage and feeling of permanence, portables have air - but old ones have mold
no opinion	permanent have windows, sinks, portables have great walls and flexibility
no opinion	portables are larger, but permanent rooms have water to wash hands, clean paint brushes, etc.
no opinion	pros and cons of both
permanent	17 times, no comments -
permanent	above reasons/ less adhesives, toxic materials used in construction, light natural air
permanent	access to office, library, others at grade level
permanent	access to school facilities 'i.e. library, bathroom, water, office
permanent	access to water, air quality, size, safety quieter, close to necessities
permanent	access to water, especially for younger children
permanent	accessibility, central location to services
permanent	after teaching in a portable for 12 years I feel the ventilation in a portable is unhealthy
permanent	air quality was better and I did not get sinus infections However it is quieter
permanent	air quality, allergy problems minimized, learning enhanced
permanent	at [my school] they are superior more natural light- more cabinet space and access to a work room
permanent	because I have a sink and wonderful storage cupboards
permanent	because they seem to get more perks. 'i.e. new carpet
permanent	better air circulation, although not sure at this site
permanent	cabinets/storage & work room
permanent	centrally located to lib, restrooms, water, office etc
permanent	classrooms have running water (usually) and the floors are solid and make less noise when walking etc.
permanent	cleaner, brighter, doesn't have musty or chemical portable odor
permanent	cleaner, more storage, less mildew
permanent	closer to copy machines and central pod location for easier access to other classes and work area space
permanent	closer to mail building, access to water in room
permanent	closer to office, supplies, library/computer lab and other teachers
permanent	closer to office/bathroom/workroom/multipurpose room etc.
permanent	closer to other rooms and the office
permanent	closer to the office, work room (but there is no fresh air flow
permanent	closer to things I need, bathrooms, office, copiers-also running water in the classroom
permanent	closer to water source, clean hands and room are important to overall health of teachers and students
permanent	easier access to office, workroom etc. water availability, noise, no clumping floors, safety when working on weekends, nights, etc
permanent	feels substantial lets children know they are important and that things are not temporary
permanent	generally have better location
permanent	generally more cupboard space and windows, electrical and plumbing
permanent	has water
permanent	I am concerned about the health issues for myself and my students
permanent	I don't like the potential of mold and the space for re-circulated air. There are many leaks in the two portables I have been in
permanent	I don't mind either on as long as they fit the criteria above

permanent	I feel like a part of the school building
permanent	I feel more connected to the rest of the school, and I like having running water. I feel safer.
permanent	I feel they are safer in the event of an earthquake
permanent	I firmly believe that portables contribute to poor health (colds etc)
permanent	I had bad experiences in my portable, allergies, also, I do not like the storage or too rectangular configuration
permanent	I have a drain under my portable, I have allergies to mold and mildew
permanent	I have had so many bad experiences with the air quality in portables I bought myself an air filter this year and I have had parents come to me and say their children's health has improved
permanent	I haven't had opportunity because of storage
permanent	I just like having a sink, If portables had sinks I really wouldn't mind teaching in one
permanent	I like being a part of the main bldg
permanent	I like the built in storage
permanent	I like the logistics and ability to team with others in a permanent classroom, but I also like the portables because they are more self contained. I can be noisy and quiet when I choose
permanent	I like to keep things clean and orderly, much easier to do w/storage and water
permanent	I prefer being close tot he center of the school and portables are usually located out on the playground
permanent	I prefer closed classrooms
permanent	I teach K with 30 kids and I need a bathroom in my room
permanent	If I can open the windows and doors, [at three schools] there is nothing that opens
permanent	If I could have a permanent classroom with doors I would prefer that
permanent	I'm a male teacher. I like working in open portables because of misunderstandings that could happen
permanent	it has more windows, its larger, and it has a sink in the room
permanent	it has sinks
permanent	it is closer to facilities(office, copiers, restroom) and it is larger than portables
permanent	I've been in both and they both have positive and negative qualities. It; up to the teacher to make the environment workable
permanent	larger
permanent	larger
permanent	larger, has windows, more storage space
permanent	larger, more storage space
permanent	larger, sink available
permanent	less echo sounding/better continuos ventilation and air flow (heat or cool
permanent	less mildew
permanent	less noise, more room, smell portables at our school have a bad smell
permanent	less noise, more built-in storage, sinks, safer in an earthquake, close to center of school
permanent	less odor more ventilation
permanent	less sterile looking more in the school mainstream
permanent	lots of cupboard space not matter what
permanent	more built-in storage sink more charm
permanent	more closets etc
permanent	more convenient, running water, centrally located , more attractive, more quiet
permanent	more light, wall space, open feeling of it
permanent	more solid, don't leak, don't smell like artificial-allergenic materials, larger plus cabinets and plumbing
permanent	more space sink and drinking fountain, students need to be able to wash their hands without running to the restroom at all times
permanent	more storage and windows
permanent	more storage, but like portables because they are closed.
permanent	more windows, better view larger. Also there have been complaints about allergy problems in portables from teachers and students
permanent	more windows, lighter
permanent	more windows, sink, more storage, wiring
permanent	newer portables are fine, but some older ones leak and have musty odors
permanent	no mildew, better HVAC, noise from walking on portable floor is annoying
permanent	noise and ventilation
permanent	noise level lower, more storage, sink in classroom, bulletin boards, nicer atmosphere
permanent	obvious
permanent	part of the building
permanent	permanent classrooms provide a sturdier, quieter more spacious environment - better insulated, no noisy ramps or noise from neighboring portables, also the long hallway environment does not make efficient use of space and deal with real classroom needs.
permanent	permanent for a sink, no mold or fungus that portables get, new portable great for hanging student work
permanent	portable - we only received Sparkletts recently - no sink - little coverage during rainy day, far from restroom
permanent	portable classrooms tend to give students with allergies more problems. Many do not have running water or appropriate storage.
permanent	portable is far away from main facilities, no attached workroom, noises echo and air conditioning make it difficult to hear, some are too small, not enough cabinets
permanent	portable lack storage, water, adequate natural light, often have stronger odors from industrial glues, easier to break into, located on perimeter of the school
permanent	portable smell musty no sink & the floor makes too much noise when kids move around
permanent	portables are poorly constructed, floor and ramp noisy, no storage, no sinks (water

permanent	portables are too far away from facilities
permanent	portables don't provide running water, they're far away for emergencies, restrooms, copy machines, no storage for supplies compared to building with pods
permanent	portables stink
permanent	portables tend to take on a musty smell, have few windows, they're cramped; no sinks
permanent	possible built in cabinets/solid foundation
permanent	provides a greater sense of stability and has tech and sink/water
permanent	quiet
permanent	quieter
permanent	quieter, usually larger, access to center workroom
permanent	ramps are too noisy for portables not enough windows
permanent	reasons in question 19
permanent	right now I'm in 1/3 of a portable and it is very crowded. However, it looks like next year, I'll be in a larger permanent classroom
permanent	roomier and aesthetically more appealing
permanent	running water, students aren't drenched on rainy days, better accessibility to other teachers
permanent	safer for 1st graders to be in the building, sink in classrooms close to bathrooms, two times larger than my portable, available storage, cleaner air, printers nearby, more stable in an earthquake
permanent	seems safer, less allergy troubles
permanent	sink - water
permanent	sink and built in cabinets and drawers
permanent	sink and storage
permanent	sink, closer to supplies, closer to bathroom, closer to peers
permanent	sink/accessible to water for cleanup
permanent	size is larger and more natural light
permanent	size of room availability of a sink/water, and built in cabinets for storage of classroom materials, location to office
permanent	size, accessibility, central location to services
permanent	size, smell , water
permanent	size, storage space, ventilation
permanent	size, ventilation
permanent	smell, dampness
permanent	solid, less noisy
permanent	sometimes portables have an unpleasant odor
permanent	space, availability of sink and fountain in class, storage, proximity to colleagues
permanent	space, not portables because of space, noise and air quality
permanent	space, sink, storage
permanent	storage and access to main bldg.
permanent	storage behind boards, sink area, wall of windows
permanent	storage, magnetic whiteboards, soundproof(floors, walls etc.
permanent	storage, sinks
permanent	storage, space, proximity to office
permanent	storage/building access- bathroom, teacher's lounge/pod access/cleaner and nicer rooms- our portables are dirty and ugly dust causes allergies
permanent	the classroom should have running water, space in which to move for collaborative groups and fresh air or air conditioning we have no drinking fountain or sink
permanent	the issues listed above
permanent	The older portables have a distinct odor, are rarely cleaned, carpets are dirty and swept about once per week, no indoor water, no center work area, no small group area for parent helpers
permanent	The permanent classrooms have better build-in cabinets, pods, for working space and proximity to office, restrooms, running water/sinks and team members. Also the permanent classrooms have better computers/ printer equipment.
permanent	the portables now are not a full size portables long rectangular in shape that do not allow for flexible movement
permanent	the room is brighter, storage space and cleaner
permanent	there is usually a lot more storage space and it is more secure, inside or attached to a building
permanent	they are larger and they have sinks w/air. Storage is much better
permanent	they are usually on the central part of the campus
permanent	they usually have two exits and running water as well as larger size
permanent	They're larger, have more storage and are usually closer to teacher workroom and restrooms
permanent	usually the size and shape of permanent, at least at the schools I've been
permanent	view
permanent	want a sink-water-windows that open (lots of windows)
permanent	water availability, proximity to office
permanent	less distractions, usually have a sink, closer to main school, not as dirty
permanent	water
permanent	water and phone available in the classroom
permanent	water supply, safety and health issues(portables have too many formaldehyde fumes and molds
permanent	water, built in storage
permanent	water, closeness to necessities for young children

permanent	water, hallways cover
permanent	water, sink - part of community
permanent	you have more contact with other colleagues
portable	3 times, no comments
portable	air conditioning, control of my thermostat
portable	at my school the permanent classrooms have very small or no windows, none of which can be opened. The doors open up to a central atrium where students eat lunch and it is very noisy. Also I like having my own thermostat to control climate not central air.
portable	At this school site only portable classrooms can be closed off from other classrooms and noises, however as a teacher you sacrifice necessary items, 1. use of sinks and water for projects hygiene and fluids that are much needed. Releasing or waiting for 30 students (sometimes 90 students after PE periods to get drinks causes huge losses of time. we have only 2 drinking fountains for all students outside. Our temperatures are usually warm and students require water to drink. 2. Use of built in storage so room is cluttered and creates a maze. 3 proximity to main office, student and teacher bathroom facilities, work space areas and telephones. All of these are a problem and eat away at precious time for both students and teachers. On a more positive side, cold temperatures esp. air conditioning are very uncomfortable for my body. I like being able to adjust the a/c. heat and air ventilation. The down side of this is the a/c. unit makes lots of noise and makes hearing students and teacher more difficult so you have to raise voice, ask for repeats or be very stuffy and uncomfortable during oral reading or discussions, reports etc.
portable	because at our school the walls are not permanent
portable	because climate can be controlled by teacher
portable	because it is enclosed and quiet, otherwise I would prefer a permanent classroom where rooms are not open
portable	because o the noise situation in the building, this used to be an open school. Now thin portable walls separate the rooms
portable	because of the noise factor in building
portable	because quiet, self contained
portable	because the portable classrooms are usually larger
portable	bigger
portable	bulletin boards
portable	depends on set up of school, open school environment
portable	due to 20-1 the inside classrooms were reduced in size substantially
portable	has air conditioning
portable	I know who's making the noise. My class, not my neighboring teacher's. Also I can control the temperature
portable	I like being control of my own noise instead of an open area
portable	in this school permanent rooms have some open walls
portable	Its much larger than the permanent classroom
portable	larger, less distractions
portable	lends for flexibility (walls are often not sound proof in a permanent building - some are simply sight barriers
portable	more room for reading groups and older kids upper grade
portable	more space
portable	more space for 32 students
portable	much quieter, more room to move around especially [my school]. When I taught at O[my previous school] I liked the permanent rooms
portable	my portable is in better condition than the permanent classrooms at my school. I have air conditioning and bulletin board walls
portable	noise doesn't drift between rooms
portable	only because our portables have air conditioning for our year round classes through the end of July
portable	permanent classrooms open into each other, no doors/or privacy
portable	prefer if provided with adequate storage, they are larger and generally brighter than permanent rooms
portable	quieter room environment than the open classroom building
portable	the classrooms inside the building are open-space classrooms
portable	the rest of [my school] is an open school and it can be very noisy
portable	The state portables are the largest on campus. The small ones are ridiculous for anyone to teach in

7.2.3 Additional Comments

Answers to Question 18 (a.k.a. Voices from the trenches)

I use an overhead projector everyday, I wish my ac was quieter

Does mold and other bacteria grow under portables? Air conditioner, which is necessary, is too noisy.

Noise is a huge problem, it sometimes seems louder in adjoining classrooms than in the room creating the noise. My classroom is in a pod adjoining 3 other open classes.

We need walls & doors to function. Permanent classrooms are so poorly designed, noisy, with inability to turn off lights since they are also used by other classrooms.

My portable is right next to the playground. I can not open my door for fresh air between 9-12:45 then the afternoon PE begins. The blower on the AC is very loud making it hard to teach over. My window and door are on the same side so I get no cross ventilation.

The best schools I've seen were old ones - with banks of windows to open (on both sides of the room, for cross ventilation) and a sink with water. I know [my school] won architectural awards but its not a good building for a school. Note: 19 - Windows so we're not closed in.

As long as the school as an open environment allowing noise to travel to other classrooms I vote for a portable. I believe I do a better teaching job.

Note question 18, reduced class sizes in lower grades forced upper grades with higher class sizes into portables question 21, I tried using portable fans because they were quieter but they were not able to move the air around enough. Comments, I have read that natural lighting has made a significant difference in student achievement as well as starting times.

My air conditioning unit is very loud it interferes with teaching, also we face a busy street - street noise.

Darken room only when we're watching an educational video (not every day but every time we watch a video.

I can only open the windows in the back of the portables. If I open the front windows it is too noisy. I face the playground and recess occurs all day long (each grade level is on a different recess schedule) The noise was problematic during testing from recess. curtains would be a good idea for the portables facing the playground like mine. The students get distracted with watching other students playing.

Please do not give this to teachers and expect to get it back immediately. A little professional courtesy (especially at the end of the year) would be appreciated.

I close the skylight to darken the room when watching a video.

Having internet access is wonderful, but printing to printer in the bldg. Is very inconvenient. It is also very difficult not having water in the classroom.

Mold in portables under ground problem for allergies. Portables need 2 exit doors. Please help Calif. Get more square footage per child. It's crazy. Especially with computers taking more space. No phones in our portables, no link to office, no water.

Carpeting is not cleaned enough or rather not replaced often enough! It is disgusting. Give me linoleum floors with an area rug any day.

My room is either too hot or too cold. Air circulation and proper temperature almost a impossible feat to obtain.

Tremendous construction has been going on for the last two years, really bad during STAR testing this year. Jack hammer one day and ground pounder and earth movers.

Lights will be out when I use the overhead projector.

I have no door, I must leave through another teacher's classroom, I have no access tot he lights. We are a middle room. The circuits are in the outside rooms, it is unsafe residing in the middle room. We have enough land to build permanent wings on our school site. Please help us to improve instruction by increasing classroom size.

I have no secondary window to use for cross ventilation and the air conditioning unit has to be shut off for students to hear instruction. They tried to adjust it but it is still too loud. If I had a second window, I probably wouldn't need to use it at all which would save a lot of money and energy.

I would love to be able to close off some of the noise around me.

Our school is open space so its impossible to control the noise level around us.

Several of the lights that are controlled by the switch in my classroom are located in the classroom next door. I feel it is important to have a quiet working environment. Although we have an 'open' school environment, it would be helpful to install walls and doors between the classrooms.

I do not have any control of my lights in fact sometimes partial lights are turned off because of other classrooms. As of this month May my air conditioner has begun to work and has been broken since Sept. I would love to have a door and complete walls so sounds couldn't come in my class. which hinders learning when children can't hear.

Storage space in my school and room could easily be converted as described above. I have asked for a Formica countertop to replace the hardboard top for the past eight years with no success. Why were the same type drapes used for replacement when they have been very unsatisfactory all these years. Why not tinting or shatter proof windows (tinted) used for replacement

Orientation is important my room's wing runs NE to SW/ very little direct sun enters. Porch covers help

I use the overhead projector often with the lights off

Our heating systems it either is on full blast or it's off. It can't be adjusted. Rooms are very dirty, not cleaned until the end of year or I clean it all the time myself

I don't adjust the thermostat but I do turn on the heater in the morning to warm up the room. I close the door when children walk by who are coming back from upper grade recess

Very unhandy to close curtains- portable fan is mine, very hot in Sept/Oct. no air cond. Window provide no ventilation

I do like our cathedral ceiling and whiteboards, The drapes are horrible. They are almost impossible to close so we do without closing them sometimes even when darkness is desired. Irony, drapes were just replaced with the same difficult set. Vertical blinds would be nice. Fan blows papers around. Heater is extremely noisy

Question 21 teacher also answered N/A to last 7 responses with memo. I share a large room with a wall that was built to divide it in half, we share lights, thermostat, etc.

In a shared classroom with a drywall separating the two our lights were the same, so we could not turn them off during teaching time. We also shared a phone and a sink

Note question 18, we did a drawing out of a hat, we agreed on that.

Lights work on 1 switch I turn them off for the overhead, computers, and TV screens. Note question 19, unnumbered answers, storage, bulletin boards

The classroom has an electrical problem and at times throughout the year a group of lights has been out

My classroom is about 18' wide and 30' long. Way too narrow to adequately teach 7-8 yr. Olds.

All classrooms should have windows that open. This school doesn't and kids (myself included) are always suffering congestion, headaches, sneezing. Our school is old and is in desperate need of the vents replaced and proper a/c. It's hard to learn when you're sneezing all day and suffering from headaches

Fresh air and ventilation are very important in keeping students alert and the classroom light and airy for maximum learning

This is an old school, the black soot coming out of the vents is frightening. Since we were built on an open structure basis, and then changed to open the a/c ventilation system is very substandard. I'm quite sure it contributes to germ infestation.

The best thing about my portable is the control over the heat and air conditioning. The permanent bldg. Doesn't have individual control. It's always a problem

I have no windows in my room and I must walk through another class to get to an outside door, I have no light switch, it is in another classroom

I have been in several rooms in different districts and feel that windows or lack of in my classroom has had a major impact on my teaching and the students learning

I consider the physical environment to be an extremely important factor in student parent and teacher attitudes and feeling about school

I'd love to open windows but noise is always a problem. The lights in the classroom seem insufficient, but we get use to them. The light is grayish.

I do not have blinds to block out light

If the permanent classroom had a door access to the adjoining classrooms, I would find this more ideal. I enjoy the open environment, but find it inconvenient when it comes to testing situations and quiet time

I have an open classroom in a pod situation. While it is conducive to team building and support from fellow teachers, it is noisier and distracting to my students, I would prefer doors

I think children perform better in a closed classroom with few interruptions

Temp. control is a major problem in my room which is colder than the others on my system. Noise level is high from male teacher next door (panels separate rooms) whose voice booms

My windows won't open properly or I would open them regularly. My classroom has poor lighting. As a wearer of glasses this provides difficulty for me. I feel eye strain on overcast days. I also receive weekly complaints from students regarding poor lighting. I truly feel that this problem at [my school] has been made known yet nothing has been done about it.

Permanent classrooms tend to be bigger. The children need space to move around. I love my classroom and would not be happy in a portable.

Many portable classrooms are in need of repair or replacement, especially on older campus grounds.

Although we have been told that our windows have been tinted for sun glare this proves to be ineffective. Teachers still have to construct devices that cover the windows to reduce glare and darken the room.

Did CUSD hire you to do this survey?

I have also taught in an open classroom where students can hear and see what's going on in all classrooms. This is the most ill conceived structure for learning, note question 21 windows don't open.

You can't give me a survey and expect that I drop everything I do so can fill it out and return it to the office the same day. Please respect my teaching responsibilities next time.

I think upper graders should get priority on the bigger classrooms. It doesn't make sense that a class of 20 smaller students has a bigger room than a class of 29 bigger students.

I currently enjoy my classroom very much. It is what I consider large: have sinks, air conditioning and storage. I am not against portables but against not been given a full size portable. I believe it is good for myself and students to breathe in some fresh air, helps us all think.

I like a lot of white board room in front, back, and the sides.

Because kindergarten is considered 20-1 but it's not considering we still have 34 bodies to accommodate I doubt the extra fixtures (, closet for back packs) will ever be addressed.

Can improvement be made on the upkeep of our buildings? The floors that bounce when there's movement in our room or next door, record players skip and overhead projection jumps on the screen.

We'd like more space! Tiny portables for tiny people don't offer room for the extra movement that happens ALL DAY.

Teaching pre-school without running water makes me feel like it's the 1900s. We carry pails of water! Also we share inadequate bathroom facilities with the rest of the school. The floor is often wet and slippery.

20-1 is great, but when classroom size is so greatly reduced stress is increased noise increased no room for centers.

My class is part of a large classroom, I have no access to thermostat, intercoms are shared.

Teachers need lots of storage space.

I love my room but I would like to have more light (natural).

I loved my previous room because it had a large skylight with adjustable blinds. I wish my current room had more windows instead of narrow slits.

I would love to have a window and door. If they put a door up we wouldn't get ventilation.

After teaching [at my school] for five years I have come to really appreciate the effects of natural light and closed classrooms. The only thing I would change about my classroom is not having a glass slider between my room and room #15 and having direct access to the work room. With 30+ 4th graders it would also be nice to have extra square footage.

I turn off ac before propping door open, I miss having windows to open, I try hard to conserve energy by not using all lights all time.

Our rooms are open, without windows, it can be distracting due to noise of other classes.

I helped open the school, and we had choice of classroom since then I feel that being in a room gives me priority for it, unless I change grade levels. Teach w/all lights out only when doing projects requiring it(science) or when using an overhead. Wind and noise keep me from opening my door more often. Adjusting my thermostat doesn't do much good.

My classroom has very poor air circulation due to construction of walls to form additional classes. No windows open, open door is too noisy.

I was happy with my location and still am.

Lights in my room are also controlled by other rooms I can't turn off all the lights for a movie because it would effect surrounding classrooms.

Wish I could open a window, very noisy only crack back window. Open door for ventilation except at others recess and lunch noise.

The portable I am in is way too small for 21 bodies. The size absolutely affects learning in my classroom. It makes an already challenging job that much more difficult. Small rooms like mine are not shaped or equipped (heard of

painting/cleaning/washing hands without water for 20 six year olds) for children this age. These tiny rooms are far from the best interest for a learning environment for young children.

I have a great room. We always keep our doors shut to keep it cool inside and it is noisy in the lunch area right outside our door. We darken the room to watch movies. As a ritual I turn out some lights when I read to the class.

The light provided by the skylight make teaching with an overhead projector excellent.

A room with theatre-like wall for projection would be great if we had projection devices.

My thermostat runs on extremes - My class gets way hot/stuffy or chilly w/quite a breeze depending on fluctuation between 1 or 2 degrees (i.e. 71 hot 70 cold.

No window to open. Superintendent's instructions do not allow for open doors in air-conditioned rooms. I can and do close the louvers in the sky light at times.

The so-called double wide portables are too small! I am in the middle room and the students do not have enough space to move around. Most large projects are eliminated because of lack of space and no access to water. The room is so small that we use the ramp outside to set up centers. The door is always open because the poor circulation in the room gets us sick, since we have no water to wash our hands after sneezing and coughing all over them, we get sick more often and pass colds, flu etc to each other because of our close proximity.

Have custodian adjust heat/cool up or down. Sometimes lights off when I do a read aloud.

My room is bright/clean/with air conditioning. If it were larger, it would be a perfect learning environment. P.S. I have a great view.

Magnet white boards portable classrooms don't have them.

Note from section a question 6- not here anymore, it was a portable which was put on our campus in Nov. and removed during the summer. Before that I was in a very old portable that ended up being re-roofed, carpeted etc. I got very sick in that old portable. Our classroom portable numbers change yearly, depending on how many portables we have —question 22 comments I'm so glad you are looking at this. I'd love to help you more. I've been at 5 schools in my district in the past 21 years feel free to contact me again.

I hate my classroom this year! I am in a portable without a sink, removed from campus, and it takes us 10 min each way to the playground. To make matters worse I am next door to adult special ed (they make a lot of noise) and next to a school that is operating out of a church (noise) Plus we face a busy street with construction going on all year. The noise and constant traffic drives me crazy. Oops almost forgot to mention the room is infested with mice. Although traps have been set, the mice no longer enter them, and because of the children, poison cannot be put out.

Student performance on tests is primarily based on 3 factors, educational level of parent, student work habits and the test itself and correlation to curriculum.

I realize that 20-1 has created the need for portables, but they're highly inconvenient for both students and teachers. Could teachers and grade levels rotate in the building.

AC comes on freezing - nice to be able to control ac but noisy and can hear recess if windows open we are treated as if not as important as those inside the main bldg. No restroom, no workroom. 98-99 we had to fight to get white boards that erased. (additional comments from this teacher, question 19- My primary concern is having 40 kids in the room for a rainy day lunch w/1/2 noon supervisor. Also, no soap we would like Purell or wetwipes supplied for us. Question 20. have to push in TV up the ramp many of us share this TV. question 21-97-98 I was housed in the YMCA rm. I could not use the room after school and was treated very rudely. The Y presently uses our picnic tables and leaves much garbage daily.

I'm really a long distance from bathrooms and the teacher's workroom It's frustrating to be crowded.

Portable ventilation is poor, either it is freezing or stuffy. Students are encouraged to dress in layers for this situation. Proximity to restrooms and team members truly increases our ability to effective and efficient. Also we are concerned with hygiene due to lack of running water and sinks. Teachers are purchasing Purell or wetwipes with own money for students. Thank you for looking at this very important issue.

Door opens to lunch tables, we have 4 different lunch times and the noise makes it impossible to leave the door open. I have a skylight and keep it open (automatic shutters) all the time for the natural sunlight. A plus for portables is that the door and windows open up to the outside, natural light & fresh air. I work inside the building.

I would add a window particularly with a view, to my choices in #19. I have a few slits for windows I find better than nothing. I would hate to teach inside a building with no natural light.

Please do not disregard the cleaning, dust, mold, etc of the rooms. Also, portables need to have running water and sinks for drainage.

I love my room, just not the location.

7.3 Bias Analysis Models

New Model Capistrano, Teacher Bias Analysis - 28-2 (Original population) Reading Daylight				Change new-old R^2	Old Model Capistrano, Original Analysis C17-ed Reading Daylight			
Model R^2	**0.248**			0.002	**Model R^2**	**0.246**		
	B	Std. Error	p (Signif)	B		B	Std. Error	p (Signif)
(Constant)	3.009	0.303	0.000		(Constant)	3.025	0.298	0.000
Classroom characteristics					Classroom characteristics			
Daylight code	**0.475**	**0.086**	**0.000**	**0.011**	**Daylight code**	**0.464**	**0.085**	**0.000**
Operable windows	0.650	0.212	0.002	0.007	Operable windows	0.643	0.212	0.002
Teacher Characteristics								
Teacher 3	-0.917	0.288	0.001					
Teacher 5	-1.335	0.388	0.001					
Log yrs teaching	0.221	0.090	0.014					
Student characteristics					Student characteristics			
Grade 2	10.823	0.251	0.000	-0.037	Grade 2	10.860	0.251	0.000
Grade 3	4.368	0.255	0.000	0.069	Grade 3	4.298	0.254	0.000
Grade 4	0.944	0.252	0.000	0.008	Grade 4	0.937	0.252	0.000
GATE program	-1.432	0.257	0.000	0.020	GATE program	-1.452	0.257	0.000
LANG program	0.827	0.239	0.001	-0.011	LANG program	0.838	0.239	0.000
School sites					School sites			
Sch 61	2.173	0.371	0.000	-0.022	SCH 61	2.195	0.370	0.000
Sch 62	1.634	0.485	0.001	0.049	SCH 62	1.584	0.477	0.001
Sch 64	2.536	0.638	0.000	0.019	SCH 64	2.517	0.638	0.000
Sch 67	1.296	0.418	0.002	-0.062	SCH 67	1.359	0.416	0.001
Sch 72	-1.486	0.378	0.000	-0.027	SCH 72	-1.460	0.376	0.000
Sch 77	0.826	0.429	0.054	-0.036	SCH 77	0.863	0.428	0.044
Sch 81	0.822	0.433	0.058	-0.168	SCH 81	0.990	0.431	0.022
Sch 82	1.664	0.450	0.000	-0.004	SCH 82	1.668	0.449	0.000
Sch 85	-1.316	0.389	0.001	-0.062	SCH 85	-1.254	0.388	0.001
Sch 73	1.574	0.515	0.002	0.047	SCH 73	1.528	0.516	0.003
Outliers					Outliers			
O 82	39.693	7.910	0.000	0.043	O 82	39.650	7.916	0.000
O 71	40.741	7.918	0.000	0.061	O 71	40.680	7.925	0.000
O 17	42.271	7.921	0.000	0.923	O 17	41.348	7.922	0.000
O 58	35.509	7.916	0.000	-0.055	O 58	35.564	7.923	0.000
O 50	36.757	7.911	0.000	0.214	O 50	36.543	7.915	0.000
O 28	-37.307	7.921	0.000	0.163	O 28	-37.470	7.926	0.000
Dependent Variable: Reading Delta (sp98-fa97)					Dependent Variable: Reading Delta (sp98-fa97)			

Figure 22 - Capistrano Reading Models, Original Population, with and without Teacher Variables

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New Model Capistrano, Teacher Analysis – 28.2 (Original population)	Math Daylight			Change new-old R^2	Old Model Capistrano, Original Analysis C17-md	Math Daylight		
Model R^2	**0.259**			**0.003**	**Model R^2**	**0.256**		
	B	Std. Error	p (Signif)	B		B	Std. Error	p (Signif)
(Constant)	9.045	0.464	0.000		(Constant)	8.026	0.407	0.000
Classroom characteristics					Classroom characteristics			
Daylight code	0.430	0.072	0.000	-0.075	Daylight code	0.504	0.067	0.000
Teacher characteristics								
Teacher 3	-0.933	0.248	0.000					
Teacher 5	-0.688	0.335	0.040					
Log yrs teaching	0.373	0.077	0.000					
Student characteristics					Student characteristics			
Grade 2	9.624	0.216	0.000	-0.088	Grade 2	9.711	0.215	0.000
Grade 3	5.949	0.220	0.000	0.018	Grade 3	5.931	0.219	0.000
Grade 4	1.802	0.216	0.000	-0.011	Grade 4	1.813	0.216	0.000
Absences unverified	-0.263	0.123	0.033	0.000	Absences unverified	-0.263	0.123	0.032
Absences unexecused	-0.029	0.014	0.043	-0.003	Absences unexecused	-0.026	0.014	0.069
GATE program	-1.191	0.222	0.000	0.045	GATE program	-1.236	0.223	0.000
Language program	0.488	0.205	0.017	-0.001	Language program	0.490	0.205	0.017
School characteristics					School characteristics			
School Pop-per 500	-0.005	0.000	0.000	-0.483	School Pop-per 500	-0.512	0.000	0.010
School sites					School sites			
SCH 59	-1.350	0.435	0.002	-0.267	SCH 59	-1.089	0.435	0.012
SCH 60	-1.114	0.397	0.009					
SCH 61	0.808	0.321	0.012	-0.091	SCH 61	0.898	0.313	0.004
SCH 62	0.992	0.403	0.014	-0.457	SCH 62	1.448	0.395	0.000
SCH 66	1.172	0.514	0.023					
					SCH 67	0.838	0.355	0.018
					SCH 71	0.803	0.429	0.061
SCH 72	-1.538	0.330	0.000	0.075	SCH 72	-1.613	0.321	0.000
SCH 74	-0.887	0.392	0.024					
SCH 77	0.963	0.366	0.009	-0.204	SCH 77	1.167	0.365	0.001
SCH 81	-0.678	0.356	0.056					
SCH 82	1.046	0.381	0.006	-0.152	SCH 82	1.198	0.379	0.002
Outliers					Outliers			
O 33	34.151	6.827	0.000	0.089	O 33	34.062	6.838	0.000
O 18	35.754	6.820	0.000	0.639	O 18	35.115	6.837	0.000
O 32	61.994	6.824	0.000	-0.461	O 32	62.456	6.835	0.000
O 48	-45.808	6.822	0.000	0.614	O 48	-46.422	6.831	0.000
O 45	-40.193	6.819	0.000	0.117	O 45	-40.310	6.830	0.000
O 02	-33.568	6.828	0.000	0.898	O 02	-34.466	6.830	0.000
Dependent Variable: MATHDELT					Dependent Variable: MATHDELT			

Figure 23 - Capistrano Math Models, Original Population, with and without Teacher Variables

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With Teacher Info Capistrano, Teacher Bias Analysis TS2 Teacher Survey Population **Model R^2**	**0.243**	Reading Daylight		Change new-old R^2 **0.004**	No Teacher Info Capistrano, Teacher Bias Analysis TS2 Teacher Survey Population **Model R^2**	**0.239**	Reading Daylight	
	B	Std. Error	p (Signif)	B		B	Std. Error	p (Signif)
(Constant)	3.277	0.520	0.000		(Constant)	3.905	0.500	0.000
Classroom characteristics					Classroom characteristics			
Daylight code	**0.463**	**0.107**	**0.000**	**0.030**	**Daylight code**	**0.434**	**0.107**	**0.000**
Operable windows	-0.599	0.296	0.043	-0.066	Operable windows	-0.533	0.296	0.072
Teacher characteristics								
Teacher 2	1.097	0.282	0.000					
Teacher 6	0.741	0.321	0.021					
Student characteristics					Student characteristics			
Grade 2	10.710	0.395	0.000	0.077	Grade 2	10.634	0.394	0.000
Grade 3	4.083	0.398	0.000	0.160	Grade 3	3.924	0.397	0.000
Grade 4	0.881	0.403	0.029	0.092	Grade 4	0.789	0.400	0.049
GATE program	-1.439	0.396	0.000	-0.006	GATE program	-1.434	0.396	0.000
Ethnic 3	0.816	0.394	0.038	-0.008	Ethnic 3	0.824	0.395	0.037
School characteristics					School characteristics			
Vintage	0.034	0.013	0.006	0.001	Vintage	0.034	0.012	0.007
School site								
Sch 61	2.269	0.606	0.000	-0.088	Sch 61	2.357	0.607	0.000
Sch 72	-2.225	0.656	0.001	0.007	Sch 72	-2.232	0.656	0.001
Sch 74	-1.568	0.634	0.013	-0.189	Sch 74	-1.379	0.634	0.030
Sch 82	1.916	0.796	0.016	-0.173	Sch 82	2.089	0.796	0.009
Sch 84	-1.417	0.826	0.086	-0.202	Sch 84	-1.216	0.823	0.140
Sch 85	-1.212	0.614	0.048	-0.225	Sch 85	-0.987	0.609	0.105
Outliers					Outliers			
O 28	-36.805	8.211	0.000	0.539	O28	-37.344	8.227	0.000
O 69	-32.407	8.217	0.000	0.365	O69	-32.772	8.235	0.000
O 17	41.258	8.222	0.000	0.628	O17	40.630	8.238	0.000

Figure 24 - Capistrano Reading Model, Teacher Survey Population, with and without Teacher Variables

With Teacher Info Capistrano, Teacher Bias Analysis TS2 Teacher Survey Population **Model R^2**	Math Daylight **0.277**			Change new-old R^2 **0.003**	No Teacher Info Capistrano, Teacher Bias Analysis TS2 Teacher Survey Population **Model R^2**	Math Daylight **0.274**		
	B	Std. Error	p (Signif)	B		B	Std. Error	p (Signif)
(Constant)	5.115	0.661	0.000		(Constant)	6.302	0.481	0.000
Classroom characteristics								
Daylight code	**0.497**	**0.105**	**0.000**	**-0.048**	**DAY_REV**	**0.544**	**0.104**	**0.000**
OPERWIN	0.801	0.301	0.008	-0.031	OPERWIN	0.831	0.297	0.005
Teacher characteristics								
Teacher 3	-0.625	0.236	0.008					
Teacher 7	0.430	0.256	0.092					
Log yrs teaching	0.464	0.197	0.019					
Student characteristics					Student characteristics			
Grade 2	10.409	0.332	0.000	0.148	Grade 2	10.261	0.328	0.000
Grade 3	6.165	0.343	0.000	0.223	Grade 3	5.941	0.338	0.000
Grade 4	1.942	0.338	0.000	0.041	Grade 4	1.901	0.338	0.000
GATE program	-1.226	0.335	0.000	-0.026	GATE program	-1.200	0.335	0.000
Ethnic 4	4.348	2.617	0.097	0.116	Ethnic 4	4.232	2.620	0.106
Ethnic 2	1.767	1.049	0.092	-0.024	Ethnic 2	1.792	1.051	0.088
School Characteristics					School Characteristics			
Vintage	0.020	0.012	0.084	0.006	Vintage	0.014	0.011	0.222
School sites					School sites			
Sch 59	-1.758	0.727	0.016	0.003	Sch 59	-1.760	0.725	0.015
Sch 60	-1.311	0.569	0.021	-0.152	Sch 60	-1.159	0.564	0.040
Sch 62	1.065	0.566	0.060	-0.241	Sch 62	1.306	0.551	0.018
Sch 67	0.887	0.530	0.095	-0.182	Sch 67	1.069	0.528	0.043
Sch 71	3.948	1.834	0.031	-0.182	Sch 71	4.130	1.830	0.024
Sch 72	-1.496	0.592	0.012	0.558	Sch 72	-2.054	0.575	0.000
Sch 77	1.424	0.684	0.038	0.190	Sch 77	1.235	0.678	0.069
Sch 82	2.577	0.692	0.000	0.146	Sch 82	2.431	0.690	0.000
Sch 83	0.986	0.526	0.061	0.112	Sch 83	0.874	0.525	0.096
Sch 84	-1.622	0.711	0.023	-0.044	Sch 84	-1.578	0.710	0.026
Sch 85	1.100	0.563	0.051	0.498	Sch 85	0.603	0.541	0.265
Sch 173	2.036	0.659	0.002	0.109	Sch 173	1.927	0.657	0.003
Outliers					Outliers			
O 48	-47.47	6.930	0.000	0.637	O 48	-48.114	6.939	0.000
O 32	62.531	6.927	0.000	-0.243	O 32	62.774	6.938	0.000

* Dependent Variable: MATHDELT

Figure 25 - Capistrano Math Model, Teacher Survey Population, with and without Teacher Variables

With Teacher Info Capistrano Teacher Bias Analysis 27-4 (expanded population) **Model R^2**	Reading Daylight **0.240**			Change new-old R^2 **-0.006**	No Teacher Info Capistrano, Original Analysis 27-4 (expanded population) **Model R^2**	Reading Daylight **0.246**		
	B	Std. Error	p (Signif)			B	Std. Error	p (Signif)
(Constant)	3.083	0.320	0.000		(Constant)	3.161	0.319	0.000
Classroom characteristics					Classroom characteristics			
Daylight code	**0.418**	**0.077**	**0.000**	**0.002**	**Daylight code**	0.416	0.076	**0.000**
Teachers characteristics								
Teacher 1	-1.649	0.551	0.003					
Teacher 3	-1.321	0.595	0.026					
Teacher 2	1.210	0.344	0.000					
Teacher 6	0.842	0.306	0.006					
Log yrs teaching	0.398	0.208	0.056					
Student characteristics					Student characteristics			
Grade 2	10.574	0.238	0.000	0.085	Grade 2	10.489	0.236	0.000
Grade 3	4.372	0.241	0.000	0.119	Grade 3	4.253	0.240	0.000
Grade 4	0.953	0.237	0.000	0.060	Grade 4	0.893	0.236	0.000
Gender	-0.298	0.165	0.070	0.010	Gender	-0.308	0.165	0.062
Ethnic 6	1.323	0.754	0.079		Ethnic 6	1.353	0.755	0.073
GATE program	-1.539	0.242	0.000	-0.018	GATE program	-1.521	0.242	0.000
Lang program	0.703	0.252	0.005	0.005	Lang program	0.698	0.252	0.006
Econ 3	-3.060	0.996	0.002		Econ 3	-2.798	0.990	0.005
Building characteristics								
Vintage	0.048	0.010	0.000		Vintage	0.049	0.010	0.000
School site					School site			
SCH 61	2.328	0.461	0.000	0.007	SCH 61	2.321	0.460	0.000
SCH 62	1.229	0.470	0.009	-0.012	SCH 62	1.242	0.463	0.007
SCH 64	3.086	0.916	0.001	0.345	SCH 64	2.742	0.904	0.002
SCH 67	1.068	0.424	0.012	0.016	SCH 67	1.051	0.420	0.012
SCH 70	1.803	0.893	0.043		SCH70	1.615	0.883	0.067
SCH 71	0.990	0.493	0.045		SCH71	0.968	0.490	0.048
SCH 72	-1.089	0.387	0.005	0.078	SCH 72	-1.167	0.386	0.002
SCH 77	0.908	0.412	0.028	-0.083	SCH 77	0.991	0.412	0.016
SCH 79	1.030	0.531	0.052		SCH 79	0.921	0.529	0.082
SCH 81	2.202	0.475	0.000	0.124	SCH 81	2.078	0.464	0.000
SCH 82	2.370	0.481	0.000	0.044	SCH 82	2.325	0.480	0.000
SCH 93	1.388	0.491	0.005	0.051	SCH 93	1.337	0.491	0.006
Outliers					Outliers			
O 82	38.594	7.884	0.000	0.078	O 82	38.517	7.892	0.000
O 71	41.114	7.882	0.000	0.080	O 71	41.034	7.891	0.000
O 17	42.753	7.885	0.000	0.913	O 17	41.841	7.890	0.000
O 28	-37.450	7.886	0.000	0.033	O 28	-37.483	7.892	0.000
O 80	-36.638	7.877	0.000		O 58	-36.746	7.886	0.000
O 69	-32.099	7.884	0.000		O 50	-32.825	7.889	0.000
Dependent Variable: READDELT					Dependent Variable: Reading Delta (sp98-fa97)			

Figure 26 - Capistrano Reading Model, Expanded Population, with and without Teacher Variables

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With Teacher Info Capistrano Teacher Bias Analysis 27-4 (expanded polulation) **Model R^2**	0.252	Math Daylight		Change new-old R^2 **0.002**	No Teacher Info Capistrano, Original Analysis 27-4 (expanded population) **Model R^2**	0.250	Math Daylight	
	B	Std. Error	p (Signif)			B	Std. Error	p (Signif)
(Constant)	7.505	0.291	0.000		(Constant)	7.558	0.291	0.000
Classroom characteristics					Classroom characteristics			
Daylight code	**0.301**	**0.066**	**0.000**	**-0.051**	**Daylight code**	**0.351**	**0.064**	**0.000**
Teacher characteristics					Teacher characteristics			
Teacher 3	-0.834	0.244	0.001					
Teacher 6	-0.846	0.357	0.018					
Log yrs teaching	0.389	0.076	0.000					
Student characteristics					Student characteristics			
Grade 2	9.442	0.205	0.000	-0.053	Grade 2	9.495	0.205	0.000
Grade 3	5.806	0.209	0.000	0.022	Grade 3	5.784	0.209	0.000
Grade 4	1.754	0.206	0.000	-0.007	Grade 4	1.761	0.206	0.000
Abscences unverified	-0.162	0.131	0.216	0.009	Abscences unverified	-0.172	0.131	0.191
Abscences unexecused	-0.029	0.014	0.037	-0.002	Abscences unexecused	-0.027	0.014	0.049
Gender	0.258	0.144	0.072	0.002	Gender	0.256	0.144	0.075
GATE program	-1.341	0.211	0.000	0.015	GATE program	-1.356	0.211	0.000
Lang program	0.611	0.217	0.005	-0.004	Lang program	0.615	0.217	0.005
Econ 3	-2.236	0.538	0.000	-0.008	Econ 3	-2.228	0.536	0.000
School characteristics					School characteristics			
Vintage	0.034	0.008	0.000	-0.001	Vintage	0.035	0.008	0.000
School site					School site			
SCH 59	-1.607	0.391	0.000	0.018	SCH 59	-1.625	0.391	0.000
SCH 60	-1.434	0.408	0.000	-0.086	SCH 60	-1.348	0.408	0.001
SCH 62	0.670	0.389	0.085	-0.242	SCH 62	0.912	0.384	0.017
SCH 69	-0.886	0.336	0.008	-0.097	SCH 69	-0.788	0.336	0.019
SCH 72	-2.206	0.337	0.000	0.087	SCH 72	-2.293	0.337	0.000
SCH 74	-0.963	0.418	0.021	-0.268	SCH 74	-0.695	0.416	0.094
SCH 77	0.890	0.367	0.015	-0.024	SCH 77	0.914	0.367	0.013
SCH 78	-0.824	0.356	0.021	0.001	SCH 78	-0.825	0.353	0.020
SCH 79	0.848	0.470	0.071	0.049	SCH79	0.799	0.470	0.089
SCH 82	1.264	0.424	0.003	-0.006	SCH82	1.270	0.424	0.003
SCH 84	-0.663	0.410	0.106	-0.001	SCH 84	-0.662	0.410	0.107
Outliers					Outliers			
O 33	34.133	6.868	0.000	0.102	O 33	34.031	6.877	0.000
O 18	34.905	6.861	0.000	0.061	O 18	34.844	6.870	0.000
O 32	62.516	6.866	0.000	-0.514	O 32	63.030	6.874	0.000
O 48	(46.018)	6.864	0.000	0.497	O 48	-46.516	6.870	0.000
O 45	(40.246)	6.860	0.000	0.275	O 45	-40.521	6.868	0.000
O 77	(36.783)	6.861	0.000	0.140	O 77	-36.924	6.870	0.000
O 02	(33.621)	6.869	0.000	0.287	O 02	-33.908	6.877	0.000
Dependent Variable: MATHDELT					Dependent Variable: MATHDELT			

Figure 27 - Capistrano Math Model, Expanded Population, with and without Teacher Variables

Descriptive Statistics — Capistrano Original Population

	N	Minimum	Maximum	Mean	Std. Dev.
Daylight Code	8268	0.000	5.000	2.029	1.241
Window Code	8268	0.000	5.000	1.364	1.093
Skylight Type A	8268	0.000	1.000	0.060	0.237
Skylight Type AA	8268	0.000	1.000	0.034	0.181
Skylight Type D	8268	0.000	1.000	0.013	0.113
Skylight Type C	8268	0.000	1.000	0.042	0.201
Skylight Type B	8268	0.000	1.000	0.041	0.197
Operable Windows	8268	0.000	1.000	0.607	0.488
Teacher 1	8268	0.000	1.000	0.295	0.456
Teacher 2	8268	0.000	1.000	0.175	0.380
Teacher 3	8268	0.000	1.000	0.182	0.386
Teacher 4	8268	0.000	1.000	0.054	0.226
Teacher 6	8268	0.000	1.000	0.101	0.301
Teacher 5	8268	0.000	1.000	0.067	0.251
Teacher 7	8268	0.000	1.000	0.179	0.384
Log yrs teaching	8268	0.000	42.000	6.641	9.190
School Pop-per 500	8268	404.000	1518.000	879.430	201.472
Classroom Pop	8268	5.000	44.000	23.896	5.886
Grade 2	8268	0.000	1.000	0.268	0.443
Grade 3	8268	0.000	1.000	0.245	0.430
Grade 4	8268	0.000	1.000	0.250	0.433
Vintage	8268	2.000	64.000	17.666	13.295
Absences Unverified - per 10	8268	0.000	12.000	0.107	0.622
Absences Unexcused -per 10	8268	0.000	60.000	5.325	5.361
Tardies	8268	0.000	105.000	4.740	8.540
Gender	8268	0.000	1.000	0.509	0.500
Ethnic 4	8268	0.000	1.000	0.003	0.050
Ethnic 1	8268	0.000	1.000	0.050	0.218
Ethnic 6	8268	0.000	1.000	0.013	0.111
Ethnic 3	8268	0.000	1.000	0.147	0.354
Ethnic 2	8268	0.000	1.000	0.015	0.121
Ethnic 7	8268	0.000	1.000	0.002	0.040
GATE program	8268	0.000	1.000	0.135	0.342
Lang program	8268	0.000	1.000	0.172	0.377
Econ 3	8268	0.000	1.000	0.147	0.203
Econ	8268	0.000	1.000	0.087	0.282
Sch 59	8268	0.000	1.000	0.032	0.176
Sch 60	8268	0.000	1.000	0.041	0.198
Sch 61	8268	0.000	1.000	0.067	0.251
Sch 62	8268	0.000	1.000	0.043	0.204
Sch 64	8268	0.000	1.000	0.020	0.142
Sch 66	8268	0.000	1.000	0.032	0.176
Sch 67	8268	0.000	1.000	0.053	0.224
Sch 69	8268	0.000	1.000	0.064	0.245
Sch 70	8268	0.000	1.000	0.035	0.185
Sch 71	8268	0.000	1.000	0.034	0.180
Sch 72	8268	0.000	1.000	0.066	0.248
Sch 74	8268	0.000	1.000	0.043	0.202
Sch 76	8268	0.000	1.000	0.046	0.210
Sch 77	8268	0.000	1.000	0.050	0.218
Sch 78	8268	0.000	1.000	0.043	0.203
Sch 79	8268	0.000	1.000	0.041	0.198
Sch 81	8268	0.000	1.000	0.056	0.229
Sch 82	8268	0.000	1.000	0.043	0.203
Sch 84	8268	0.000	1.000	0.029	0.169
Sch 85	8268	0.000	1.000	0.062	0.241
Sch 173	8268	0.000	1.000	0.031	0.172
Sch 273	8268	0.000	1.000	0.024	0.152
Valid N (listwise)	8268				

Figure 28 - Descriptive Statistics, Capistrano Original Population

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Descriptive Statistics — Capistrano Teacher Survey Population

	N	Minimum	Maximum	Mean	Std Deviation
Math Delta	3889	-29.000	79.000	13.128	8.091
Reading Delta	3809	-22.000	59.000	9.251	9.399
Daylight code	3949	0.000	5.000	2.222	1.329
Operable windows	3949	0.000	1.000	0.551	0.498
School Pop-per 500	3949	404.000	1518.000	896.234	204.224
Classroom Pop	3949	11.000	34.000	23.838	5.766
Vintage	3949	2.000	64.000	18.112	13.796
Grade 2	3949	0.000	1.000	0.294	0.456
Grade 3	3949	0.000	1.000	0.243	0.429
Grade 4	3949	0.000	1.000	0.243	0.429
Absences Unverified	3949	0.000	11.000	0.070	0.517
Absences Unexcused	3949	0.000	60.000	5.043	5.502
Tardies	3949	0.000	73.000	4.707	8.503
Gender	3949	0.000	1.000	0.514	0.500
Ethnic 4	3949	0.000	1.000	0.002	0.042
Ethnic 1	3949	0.000	1.000	0.051	0.221
Ethnic 6	3949	0.000	1.000	0.011	0.106
Ethnic 3	3949	0.000	1.000	0.150	0.357
Ethnic 2	3949	0.000	1.000	0.011	0.106
Ethnic 7	3949	0.000	1.000	0.002	0.039
GATE program	3949	0.000	1.000	0.130	0.336
Lang program	3949	0.000	1.000	0.174	0.380
Econ 3	3949	0.000	0.960	0.165	0.212
Log yrs teaching	3949	0.693	3.738	2.462	0.663
Teacher 1	3949	0.000	1.000	0.241	0.428
Teacher 2	3949	0.000	1.000	0.343	0.475
Teacher 3	3949	0.000	1.000	0.290	0.454
Teacher 4	3949	0.000	1.000	0.126	0.332
Teacher 6	3949	0.000	1.000	0.232	0.422
Teacher 7	3949	0.000	1.000	0.399	0.490
Sch 59	3949	0.000	1.000	0.028	0.165
Sch 60	3949	0.000	1.000	0.047	0.211
Sch 61	3949	0.000	1.000	0.060	0.238
Sch 62	3949	0.000	1.000	0.064	0.244
Sch 64	3949	0.000	1.000	0.022	0.145
Sch 65	3949	0.000	1.000	0.046	0.209
Sch 66	3949	0.000	1.000	0.039	0.194
Sch 67	3949	0.000	1.000	0.058	0.234
Sch 68	3949	0.000	1.000	0.045	0.207
Sch 69	3949	0.000	1.000	0.041	0.197
Sch 70	3949	0.000	1.000	0.004	0.062
Sch 72	3949	0.000	1.000	0.049	0.215
Sch 74	3949	0.000	1.000	0.046	0.210
Sch 76	3949	0.000	1.000	0.033	0.178
Sch 77	3949	0.000	1.000	0.036	0.186
Sch 78	3949	0.000	1.000	0.059	0.236
Sch 79	3949	0.000	1.000	0.020	0.139
Sch 81	3949	0.000	1.000	0.065	0.247
Sch 82	3949	0.000	1.000	0.030	0.171
Sch 83	3949	0.000	1.000	0.063	0.244
Sch 84	3949	0.000	1.000	0.031	0.172
Sch 85	3949	0.000	1.000	0.059	0.236
Sch 93	3949	0.000	1.000	0.032	0.176
Sch 94	3949	0.000	1.000	0.025	0.155
Valid N (listwise)	3862				

Figure 29 - Descriptive Statistics, Capistrano Teacher Survey Population

Descriptive Statistics — Capistrano Expanded Population

	N	Minimum	Maximum	Mean	Std. Deviation
Math Delta	9186	-29.000	79.000	12.565	7.914
Reading Delta	9195	-22.000	59.000	8.771	9.010
Daylight Code	9302	0.000	5.000	1.977	1.240
Operable Windows	9302	0.000	1.000	0.574	0.495
School Pop-per 500	9302	404.000	1518.000	886.693	190.423
Classroom Pop	9302	5.000	44.000	23.880	5.885
Grade 2	9302	0.000	1.000	0.273	0.446
Grade 3	9302	0.000	1.000	0.244	0.429
Grade 4	9302	0.000	1.000	0.248	0.432
Absences Unverified	9302	0.000	12.000	0.094	0.584
Absences Unexcused	9302	0.000	60.000	4.672	5.324
Tardies	9302	0.000	105.000	4.143	8.146
Gender	9302	0.000	1.000	0.508	0.500
Vintage	9302	2.000	64.000	16.844	13.157
Ethnic 4	9302	0.000	1.000	0.002	0.047
Ethnic 1	9302	0.000	1.000	0.052	0.222
Ethnic 6	9302	0.000	1.000	0.012	0.110
Ethnic 3	9302	0.000	1.000	0.139	0.346
Ethnic 2	9302	0.000	1.000	0.014	0.117
Ethnic 7	9302	0.000	1.000	0.002	0.041
GATE program	9302	0.000	1.000	0.138	0.345
Lang program	9302	0.000	1.000	0.164	0.371
Econ 3	9302	0.000	1.000	0.153	0.199
Teacher 1	9302	0.000	1.000	0.248	0.432
Teacher 3	9302	0.000	1.000	0.177	0.381
Teacher 2	9302	0.000	1.000	0.146	0.353
Teacher 4	9302	0.000	1.000	0.053	0.225
Teacher 5	9302	0.000	1.000	0.052	0.222
Teacher 6	9302	0.000	1.000	0.098	0.298
Teacher 7	9302	0.000	1.000	0.170	0.375
Log yrs teaching	9302	0.000	3.738	1.045	1.291
Sch 59	9302	0.000	1.000	0.038	0.191
Sch 60	9302	0.000	1.000	0.038	0.191
Sch 61	9302	0.000	1.000	0.048	0.213
Sch 62	9302	0.000	1.000	0.042	0.200
Sch 64	9302	0.000	1.000	0.018	0.134
Sch 66	9302	0.000	1.000	0.028	0.164
Sch 67	9302	0.000	1.000	0.046	0.209
Sch 68	9302	0.000	1.000	0.033	0.179
Sch 69	9302	0.000	1.000	0.055	0.228
Sch 70	9302	0.000	1.000	0.032	0.177
Sch 71	9302	0.000	1.000	0.031	0.172
Sch 72	9302	0.000	1.000	0.053	0.225
Sch 74	9302	0.000	1.000	0.033	0.179
Sch 76	9302	0.000	1.000	0.043	0.203
Sch 77	9302	0.000	1.000	0.047	0.211
Sch 78	9302	0.000	1.000	0.048	0.214
Sch 79	9302	0.000	1.000	0.026	0.159
Sch 80	9302	0.000	1.000	0.045	0.207
Sch 81	9302	0.000	1.000	0.043	0.203
Sch 82	9302	0.000	1.000	0.035	0.183
Sch 83	9302	0.000	1.000	0.045	0.207
Sch 84	9302	0.000	1.000	0.040	0.196
Sch 85	9302	0.000	1.000	0.051	0.219
Sch 93	9302	0.000	1.000	0.030	0.171
Sch 94	9302	0.000	1.000	0.021	0.142
Valid N (listwise)	9123				

Figure 30 - Descriptive Statistics, Capistrano Expanded Population

7.4 Grade Level Models

New Model Capistrano Grade Level Interaction CGL6-rd		Reading Daylight		Change new-old R^2	Old Model Capistrano, Original Analysis C17-rd		Reading Daylight	
Model R^2	**0.239**			**-0.007**	**Model R^2**	**0.246**		
	B	Std. Error	p (Signif)	B		B	Std. Error	p (Signif)
(Constant)	2.774	0.399	0.000		(Constant)	3.025	0.298	0.000
Classroom Characteristics					Classroom Characteristics			
Daylight Code	**0.396**	**0.080**	**0.000**	**-0.068**	**Daylight code**	**0.464**	**0.085**	**0.000**
					Operable Window	0.643	0.212	0.002
Teacher Characteristics								
Teacher 1	-1.148	0.493	0.020					
Teacher 2	1.134	0.344	0.001					
Teacher 6	0.625	0.308	0.043					
Student Characteristics					Student Characteristics			
Grade 2	12.478	1.041	0.000	1.618	Grade 2	10.860	0.251	0.000
Grade 3	5.819	1.432	0.000	1.521	Grade 3	4.298	0.254	0.000
				-0.937	Grade 4	0.937	0.252	0.000
Ethnic 6	1.306	0.746	0.080					
GATE Program	1.086	0.485	0.025	2.537	GATE Program	-1.452	0.257	0.000
Lang Prog	0.441	0.525	0.400	-0.397	Lang Prog	0.838	0.239	0.000
Econ 3	-4.077	1.307	0.002					
School Characteristics					School Characteristics			
Vintage	0.054	0.011	0.000					
School Site					School Site			
Sch 61	1.888	0.472	0.000	-0.307	Sch 61	2.195	0.370	0.000
Sch 62	0.986	0.478	0.039	-0.598	Sch 62	1.584	0.477	0.001
Sch 64	3.207	0.933	0.001	0.690	Sch 64	2.517	0.638	0.000
Sch 67	0.827	0.436	0.058	-0.532	Sch 67	1.359	0.416	0.001
Sch 70	2.277	0.923	0.014					
Sch 72	-1.262	0.402	0.002	0.198	Sch 72	-1.460	0.376	0.000
Sch 77	0.792	0.423	0.061	-0.070	Sch 77	0.863	0.428	0.044
Sch 79	1.078	0.542	0.047					
Sch 81	2.261	0.477	0.000	1.271	Sch 81	0.990	0.431	0.022
Sch 82	2.179	0.492	0.000	0.511	Sch 82	1.668	0.449	0.000
					Sch 85	-1.254	0.388	0.001
Sch 73	1.518	0.490	0.002	-0.009	Sch 73	1.528	0.516	0.003
Outliers					Outliers			
O82	37.789	7.800	0.000	-3.559	O82	39.650	7.916	0.000
O71	40.147	7.798	0.000	-0.533	O71	40.680	7.925	0.000
O17	40.288	7.803	0.000	0.638	O17	41.348	7.922	0.000
O28	-36.386	7.807	0.000	1.084	O28	-37.470	7.926	0.000
O80	-38.527	7.798	0.000		O58	35.564	7.923	0.000
O69	-31.246	7.806	0.000		O50	36.543	7.915	0.000
Interaction Variables					Dependent Variable: Reading Delta (sp98-fa97)			
OPWIN_2	0.659	0.341	0.053					
CLSPOP_4	0.122	0.060	0.041					
ABUNVE_4	0.656	0.305	0.031					
ABUNEX_2	0.061	0.031	0.048					
Gender 2	-1.234	0.460	0.007					
GATE_2	-6.856	0.691	0.000					
GATE_3	-3.016	0.671	0.000					
LANGPR_2	-1.296	0.719	0.072					
LANGPR_3	1.350	0.715	0.059					
Econ 3-2	3.411	1.622	0.036					
Teach 1-2	1.722	0.567	0.002					
Teach 3-2	-2.351	0.650	0.000					
Dependent Variable: READDELT								

Figure 31- Capistrano Grade Level Interaction, Reading Daylight

New Model Capistrano Grade Level Interaction CGL6-md		Math Daylight		Change new-old R^2	Old Model Capistrano, Original Analysis C17-md		Math Daylight	
Model R^2	**0.261**			0.005	**Model R^2**	**0.256**		
	B	Std. Error	p (Signif)	B		B	Std. Error	p (Signif)
(Constant)	7.787	0.481	0.000		(Constant)	8.026	0.407	0.000
Classroom Characteristics					Classroom Characteristics			
Daylight Code	**0.275**	**0.154**	**0.073**	-0.229	**Daylight Code**	**0.504**	**0.067**	**0.000**
Daylight Code*2nd Grade	0.320	0.190	0.093					
Teacher Characteristics					Teacher Characteristics			
none significant								
Student Characteristics					Student Characteristics			
Grade 2	11.506	0.871	0.000	1.704	SECOND	9.711	0.215	0.000
Grade 3	3.227	0.893	0.000	-2.704	THIRD	5.931	0.219	0.000
Grade 4	2.451	0.922	0.008	0.637	FOURTH	1.813	0.216	0.000
Gender	0.277	0.143	0.053					
GATE program	(1.352)	0.211	0.000	-0.115	GATE progam	-1.236	0.223	0.000
LANG program	0.566	0.216	0.009	0.077	LANG program	0.490	0.205	0.017
Econ 3	(2.390)	0.907	0.008					
					Absen Unver	-0.263	0.123	0.032
Absen Unexc	(0.030)	0.014	0.034	-0.004	Absen Unexc	-0.026	0.014	0.060
School Characteristics								
Vintage	0.038	0.014	0.008	0.038				
School Site					School Site			
SCH50	(1.818)	0.390	0.000	-0.728	SCH59	-1.089	0.435	0.012
SCH60	(1.390)	0.411	0.001					
				-0.898	SCH61	0.898	0.313	0.004
SCH62	0.644	0.387	0.096	-0.804	SCH62	1.448	0.395	0.000
					SCH67	0.838	0.355	0.018
SCH69	(0.748)	0.341	0.028					
				-0.803	SCH71	0.803	0.429	0.061
SCH72	(2.815)	0.359	0.000	-1.201	SCH72	-1.613	0.321	0.000
SCH74	(0.936)	0.421	0.026					
SCH77	0.797	0.364	0.029	-0.370	SCH77	1.167	0.365	0.001
SCH78	(0.930)	0.362	0.010					
SCH82	0.944	0.427	0.027	-0.255	SCH82	1.198	0.379	0.002
SCH84	(0.932)	0.401	0.020					
Outhers					Outhers			
O33	34.480	6.836	0.000	0.418	O33	34.062	6.838	0.000
O18	33.983	6.831	0.000	-1.132	O18	35.115	6.837	0.000
O32	61.652	6.837	0.000	-0.803	O32	62.456	6.835	0.000
O48	(46.429)	6.829	0.000	-0.007	O48	-46.422	6.831	0.000
O45	(40.698)	6.828	0.000	-0.388	O45	-40.310	6.830	0.000
O77	(35.628)	6.832	0.000					
O02	(32.938)	6.840	0.000	1.529	O02	-34.466	6.830	0.000
Interaction Variables					Dependent Variable: MATHDIFF			
Vintage 2	(0.046)	0.020	0.021					
Vintage 3	0.057	0.019	0.003					
Vintage 4	(0.063)	0.020	0.001					
School Pop 2	(0.003)	0.001	0.000					
School Pop 3	0.002	0.001	0.003					
Tardies 2	(0.030)	0.017	0.078					
Tardies 3	0.047	0.017	0.006					
Econ 3-3	(3.135)	1.190	0.008					
Econ 3-4	3.387	1.258	0.007					
Teach 1-2	2.140	0.322	0.000					
Teach 4-4	2.914	1.292	0.024					
Dependent Variable: MATHDIFF								

Figure 32- Capistrano Grade Level interaction, Math Daylight

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New Model Seattle Grade Level Interaction GL2-rd		Reading Daylight		Change new-old R^2	Old Model Seattle, orginal analysis S9-rd		Reading Daylight	
Model R^2	**0.337**			**0.040**	**Model R^2**	**0.297**		
	B	Std. Error	p (Signif)	B		B	Std. Error	p (Signif)
(Constant)	52.107	2.196	0.000		(Constant)	54.667	1.726	0.000
Classroom Characteristics					Classroom Characteristics			
Daylight Code	**2.533**	**0.373**	**0.000**	**0.650**	**Daylight Code**	**1.883**	**0.342**	**0.000**
					Portable	-2.123	1.121	0.058
Gifted room (70%+)	16.153	1.563	0.000	0.812	Gifted room (70%+)	15.342	0.894	0.000
				0.002	Class SF	-0.002	0.000	0.001
Students per Class	0.157	0.024	0.000	0.020	Students per Class	0.137	0.025	0.000
Student Characteristics					Student Characteristic			
Grade 2	15.056	2.491	0.000	8.098	Grade 2	6.957	0.596	0.000
				2.074	Grade 3	-2.074	0.523	0.000
				-0.949	Grade 4	0.949	0.529	0.073
Ethnic 2	-5.670	0.891	0.000	-1.409	Ethnic 2	-8.461	0.522	0.000
Ethnic 4	-11.016	0.550	0.000	0.152	Ethnic 4	-11.168	0.557	0.000
Ethnic 1	-8.534	1.293	0.000	-0.768	Ethnic 1	-7.766	0.797	0.000
Ethnic 3	-6.165	1.349	0.000	0.394	Ethnic 3	-6.559	1.336	0.000
				-0.912	Gender	0.912	0.380	0.016
Econ 2	-10.939	0.486	0.000	-2.264	Econ 2	-8.675	0.475	0.000
Socio 1	-3.311	1.095	0.003	1.169	Socio 1	-4.481	1.131	0.000
Socio 3	-1.616	0.452	0.000	1.001	Socio 3	-2.618	0.480	0.000
Socio 2	-1.949	0.976	0.046	1.233	Socio 2	-3.182	1.011	0.002
School Characteristics					School Characteristics			
School Pop - per 500	5.574	3.215	0.083	-1.088	School Pop - per 500	6.662	1.762	0.000
Outliers					Outliers			
O26	-63.880	16.619	0.000	1.534	O26	-65.414	16.407	0.000
O68	-66.614	16.613	0.000	1.313	O68	-67.927	16.409	0.000
O07	-68.420	16.626	0.000	1.812	O07	-70.231	16.408	0.000
O73	-72.856	16.612	0.000	-1.715	O73	-71.141	16.408	0.000
O21	-64.758	16.617	0.000	0.457	O21	-65.215	16.413	0.000
Interaction Variables					Dependent Variable: Reading NCE 98			
VINT_2ND	-0.089	0.017	0.000					
SCSZ_2ND	-0.038	0.010	0.000					
SCSZ_4TH	0.017	0.009	0.070					
Gen_2ND	4.345	1.046	0.000					
Gen_3RD	1.858	0.994	0.062					
SQFT_3RD	-0.002	0.001	0.003					
SQFT_4TH	-0.001	0.001	0.073					
Eth2_3RD	-2.191	1.173	0.062					
Eth2_4TH	-3.055	1.216	0.012					
Eth1_3RD	-5.227	1.916	0.006					
Dependent Variable: Reading NCE 98								

Figure 33- Seattle Grade Level Interaction, Reading Daylight

New Model Seattle Grade Level Interaction SGL2-md		Math Daylight		Change new-old R^2	Old Model Seattle, original anlysis S9-md		Math Daylight	
Model R^2	**0.257**			-0.001	**Model R^2**	**0.258**		Sig
	B	Std. Error	p (Signif)	B		B	Std. Error	p (Signif)
(Constant)	49.134	2.073	0.000		(Constant)	55.633	1.841	0.000
Classroom Characteristics					Classroom Characteristics			
Daylight Code	**1.585**	**0.438**	**0.000**	**0.194**	**Daylight Code**	**1.391**	**0.436**	**0.001**
Open room	3.485	1.650	0.035	-0.022	Open room	3.506	1.570	0.026
Portable	-2.496	1.174	0.033	0.562	Portable	-3.058	1.171	0.009
Gifted room (70%+)	16.312	0.931	0.000	-0.082	Gifted room (70%+)	16.394	0.931	0.000
Class SF	-0.003	0.001	0.003	-0.002	Class SF	-0.001	0.001	0.063
Students per Class	0.185	0.054	0.001	0.119	Students per Class	0.066	0.033	0.044
Student Characteristics					Student Characteristics			
Grade 2	22.935	2.612	0.000	16.832	Grade 2	6.104	0.577	0.000
Grade 3	5.013	2.336	0.032	8.401	Grade 3	-3.388	0.477	0.000
Ethnic 4	-11.440	0.537	0.000	0.011	Ethnic 4	11.452	0.538	0.000
Ethnic 1	-5.564	0.800	0.000	-0.087	Ethnic 1	-5.477	0.803	0.000
Ethnic 3	-6.974	1.376	0.000	0.004	Ethnic 3	-6.978	1.381	0.000
Gender	-2.957	0.390	0.000	0.060	Gender	-3.017	0.392	0.000
Econ 2	-5.756	0.474	0.000	0.035	Econ 2	-5.790	0.475	0.000
Socio 1	-4.408	1.163	0.000	-0.069	Socio 1	-4.339	1.167	0.000
Socio 3	-3.525	0.835	0.000	-0.418	Socio 3	-3.107	0.494	0.000
Socio 2	-4.769	1.053	0.000	-0.078	Socio 2	-4.691	1.057	0.000
School Characteristics					School Characteristics			
Vintage	0.053	0.015	0.001	0.036	Vintage	0.017	0.010	0.098
School Pop-per 500	21.459	3.081	0.000	9.937	School Pop-per 500	11.522	7.065	0.000
Outliers					Outliers			
O10143	-61.856	16.787	0.000	3.117	O10143	-64.973	16.814	0.000
O9223	57.790	16.748	0.001	-0.259	O9223	58.049	16.824	0.001
O13206	49.760	16.751	0.003	-4.640	O13206	54.400	16.802	0.001
Interaction Variables					Dependent Variable: Math NCE 98			
SCS2_2ND	-0.061	0.010	0.000					
SCS2_3RD	-0.035	0.009	0.000					
VINT_2ND	-0.121	0.022	0.000					
VINT_3RD	-0.037	0.021	0.077					
CLSZ_4TH	-0.205	0.067	0.002					
SQFT_2ND	0.002	0.001	0.079					
SQFT_4TH	0.003	0.001	0.013					
Dependent Variable: Math NCE 98								

Figure 34 - Seattle Grade Level Interaction, Math Daylight

Descriptive Statistics Capistrano Grade Level, Reading and Math

	N	Minimum	Maximum	Mean	Std. Dev.
READDELT	9195	-22.000	59.000	8.771	9.010
MATHDELT	9186	-29.000	79.000	12.565	7.914
Daylight Code	9302	0.000	5.000	1.977	1.240
Teacher 1	9302	0.000	1.000	0.248	0.432
Teacher 3	9302	0.000	1.000	0.177	0.381
Teacher 2	9302	0.000	1.000	0.146	0.353
Teacher 6	9302	0.000	1.000	0.098	0.298
Log yrs teaching	9302	0.000	3.738	1.045	1.291
Grade 2	9302	0.000	1.000	0.273	0.446
Grade 3	9302	0.000	1.000	0.244	0.429
Grade 4	9302	0.000	1.000	0.248	0.432
Vintage	9302	2.000	64.000	16.8414	13.157
Gender	9302	0.000	1.000	0.508	0.500
Ethnic 6	9302	0.000	1.000	0.012	0.110
GATE program	9302	0.000	1.000	0.138	0.345
Lang program	9302	0.000	1.000	0.164	0.371
Econ 3	9302	0.000	1.000	0.153	0.199
Sch 61	9302	0.000	1.000	0.048	0.213
Sch 62	9302	0.000	1.000	0.042	0.200
Sch 64	9302	0.000	1.000	0.018	0.134
Sch 67	9302	0.000	1.000	0.046	0.209
Sch 70	9302	0.000	1.000	0.032	0.177
Sch 71	9302	0.000	1.000	0.031	0.172
Sch 72	9302	0.000	1.000	0.053	0.225
Sch 77	9302	0.000	1.000	0.047	0.211
Sch 79	9302	0.000	1.000	0.026	0.159
Sch 81	9302	0.000	1.000	0.043	0.203
Sch 82	9302	0.000	1.000	0.035	0.183
Sch 173	9302	0.000	1.000	0.030	0.171
Valid N (listwise)	9123				

Figure 35- Descriptive statistics, Capistrano Grade Level, Reading and Math

Descriptive Statistics — Seattle Grade Level, Reading

	N	Minimum	Maximum	Mean	Std. Dev.
Reading NCE 98	7538	1.000	99.000	57.350	19.518
Daylight Code	7590	1.000	5.000	3.053	0.752
Portable	7617	0.000	1.000	0.030	0.171
Class SF	7617	638.000	3616.000	1110.707	688.906
Gifted room (70%+)	7617	0.000	1.000	0.049	0.216
Students per Class	7600	5.000	80.000	24.025	13.238
Students per School	7617	44.000	308.000	190.867	57.653
Grade 2	7617	0.000	1.000	0.214	0.410
Grade 3	7617	0.000	1.000	0.270	0.444
Grade 4	7617	0.000	1.000	0.249	0.432
Ethnic 2	7617	0.000	1.000	0.214	0.410
Ethnic 4	7617	0.000	1.000	0.227	0.419
Ethnic 1	7617	0.000	1.000	0.066	0.249
Ethnic 3	7617	0.000	1.000	0.021	0.144
Gender	7614	0.000	1.000	0.512	0.500
Econ 2	7617	0.000	1.000	0.425	0.491
Socio 1	7617	0.000	1.000	0.030	0.172
Socio 3	7617	0.000	1.000	0.288	0.453
Socio 2	7617	0.000	1.000	0.043	0.202

Figure 36- Descriptive statistics, Seattle Grade Level, Reading

Descriptive Statistics — Seattle Grade Level, Math

	N	Minimum	Maximum	Mean	Std. Dev
Math NCE 98	7422	1.000	99.000	58.820	19.467
Daylight code	7590	1.000	5.000	3.053	0.752
Open room	7617	0.000	1.000	0.104	0.306
Portable	7617	0.000	1.000	0.030	0.171
Gifted room (70%+)	7617	0.000	1.000	0.049	0.216
Vintage	7617	7.000	92.000	39.812	26.370
Class SF	7617	638.000	3616.000	1110.707	688.906
Students per Class	7600	5.000	80.000	24.025	13.238
Students per School	7617	44.000	308.000	190.663	57.653
Grade 2	7617	0.000	1.000	0.214	0.410
Grade 3	7617	0.000	1.000	0.270	0.444
Ethnic 4	7617	0.000	1.000	0.227	0.419
Ethnic 1	7617	0.000	1.000	0.066	0.249
Ethnic 3	7617	0.000	1.000	0.021	0.144
Gender	7614	0.000	1.000	0.512	0.500
Econ 2	7617	0.000	1.000	0.405	0.491
Socio 1	7617	0.000	1.000	0.030	0.172
Socio 3	7617	0.000	1.000	0.288	0.453
Socio 2	7617	0.000	1.000	0.043	0.202
Valid N (listwise)	7379				

Figure 37- Descriptive statistics, Seattle Grade Level, Math

7.5 Absenteeism Models

Capistrano Absenteeism Analysis ABS 3 LN **Model R^2** **0.049**		Std. Error	Beta	t	p (Signif)
1 (Constant)	1.651	0.061		27.050	0.000
Classroom characteristics	-0.059	0.029	-0.026	-2.025	0.043
Semi-open classroom					
Student characteristics	-0.056	0.022	-0.029	-2.564	0.010
Grade 3	-0.042	0.021	-0.022	-1.975	0.048
Grade 4	0.035	0.017	0.021	2.038	0.042
Gender	-0.470	0.042	-0.122	-11.217	0.000
Ethnic 1	-0.144	0.079	-0.019	-1.823	0.068
Ethnic 6	-0.223	0.073	-0.032	-3.038	0.002
Ethnic 2	-0.396	0.198	-0.021	-1.997	0.046
Ethnic 7	-0.100	0.027	-0.040	-3.777	0.000
GATE program	-0.154	0.027	-0.073	-5.676	0.000
Lang program	0.213	0.105	0.059	2.026	0.043
Econ 3					
School characteristics	0.006	0.001	0.093	4.377	0.000
Vintage	0.000	0.000	0.029	2.004	0.045
School Pop-per 500					
School sites	-0.105	0.047	-0.025	-2.260	0.024
Sch 59	-0.150	0.050	-0.036	-3.017	0.003
Sch 60	0.112	0.047	0.028	2.386	0.017
Sch 62	-0.454	0.081	-0.094	-5.585	0.000
Sch 64	-0.105	0.044	-0.028	-2.414	0.016
Sch 67	-0.256	0.085	-0.066	-3.020	0.003
Sch 70	-0.151	0.052	-0.034	-2.909	0.004
Sch 74	0.130	0.060	0.026	2.173	0.030
Sch 79	0.092	0.049	0.023	1.867	0.062
Sch 81	0.291	0.051	0.067	5.703	0.000
Sch 82	0.094	0.047	0.024	1.991	0.047
Sch 84	0.182	0.056	0.039	3.244	0.001
Sch 173					
Outliers	2.528	0.815	0.032	3.102	0.002
O 49					
Dependent Variable: Log of Absence days					

Figure 38 - Capistrano Absenteeism Model

Capistrano Tardiness Model
ABS 3 LN
Model R^2 0.097

	B	Std. Error	Beta	t	p (Signif)
1 (Constant)	1.305	0.096		13.623	0.000
Classroom characteristics					
Daylight code	-0.046	0.012	-0.050	-3.945	0.000
No air conditioning	0.113	0.053	0.029	2.144	0.032
Portable classroom	0.054	0.026	0.024	2.087	0.037
Teacher characteristics					
Teacher 1	0.199	0.039	0.080	5.172	0.000
Teacher 3	0.238	0.045	0.084	5.236	0.000
Teacher 7	-0.081	0.036	-0.028	-2.236	0.025
Log yrs teaching	-0.006	0.002	-0.054	-3.065	0.002
Student characteristics					
Grade 2	0.050	0.025	0.021	2.021	0.043
Ethnic 4	0.545	0.217	0.026	2.515	0.012
Ethnic 1	-0.197	0.052	-0.039	-3.803	0.000
Ethnic 3	0.160	0.037	0.055	4.327	0.000
Ethnic 2	0.424	0.093	0.046	4.541	0.000
GATE program	-0.231	0.034	-0.071	-6.839	0.000
Econ 3	0.586	0.126	0.125	4.663	0.000
School characterisics					
School Pop-per 500	0.000	0.000	-0.053	-3.189	0.001
School sites					
Sch 59	-0.393	0.060	-0.072	-6.552	0.000
Sch 60	-0.102	0.061	-0.019	-1.670	0.095
Sch 61	0.261	0.058	0.054	4.498	0.000
Sch 64	0.455	0.106	0.072	4.294	0.000
Sch 67	-0.183	0.053	-0.038	-3.434	0.001
Sch 70	-0.582	0.115	-0.114	-5.069	0.000
Sch 71	0.140	0.069	0.023	2.028	0.043
Sch 72	-0.219	0.053	-0.048	-4.163	0.000
Sch 74	-0.488	0.067	-0.084	-7.255	0.000
Sch 76	-0.183	0.058	-0.035	-3.165	0.002
Sch 84	0.161	0.055	0.031	2.901	0.004
Sch 173	0.337	0.074	0.055	4.529	0.000
Sch 273	0.207	0.092	0.028	2.253	0.024

Dependent Variable: LNYI_T

Figure 39 - Capistrano Tardiness Model

Absenteeism/Tardiness — Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Daylight code	8808	0.000	5.000	1.983	1.197
No Air conditioning	8808	0.000	1.000	0.087	0.282
Semi-open classroom	8808	0.000	1.000	0.162	0.369
Portable classroom	8808	0.000	1.000	0.403	0.491
Modular classroom	8808	0.000	1.000	0.101	0.302
Teacher 1	8808	0.000	1.000	0.260	0.439
Teacher 2	8808	0.000	1.000	0.152	0.359
Teacher 3	8808	0.000	1.000	0.180	0.384
Teacher 4	8808	0.000	1.000	0.052	0.222
Teacher 6	8808	0.000	1.000	0.099	0.299
Teacher 5	8808	0.000	1.000	0.057	0.232
Teacher 7	8808	0.000	1.000	0.165	0.371
Log yrs teaching	8808	0.000	42.000	6.315	9.219
School Pop-per 500	8808	404.000	1518.000	882.632	201.494
Classroom Pop	8808	6.000	34.000	23.422	5.934
Grade 2	8808	0.000	1.000	0.285	0.451
Grade 3	8808	0.000	1.000	0.237	0.425
Grade 4	8808	0.000	1.000	0.241	0.428
Vintage	8808	2.000	64.000	18.518	14.090
Gender	8808	0.000	1.000	0.509	0.500
Ethnic 4	8808	0.000	1.000	0.003	0.051
Ethnic 1	8808	0.000	1.000	0.049	0.216
Ethnic 6	8808	0.000	1.000	0.012	0.111
Ethnic 3	8808	0.000	1.000	0.168	0.374
Ethnic 2	8808	0.000	1.000	0.014	0.119
Ethnic 7	8808	0.000	1.000	0.002	0.044
GATE program	8808	0.000	1.000	0.130	0.336
Lang program	8808	0.000	1.000	0.190	0.392
Econ 3	8808	0.000	1.000	0.178	0.232
Sch 59	8808	0.000	1.000	0.041	0.199
Sch 60	8808	0.000	1.000	0.042	0.201
Sch 61	8808	0.000	1.000	0.054	0.226
Sch 62	8808	0.000	1.000	0.047	0.211
Sch 64	8808	0.000	1.000	0.031	0.173
Sch 67	8808	0.000	1.000	0.053	0.224
Sch 69	8808	0.000	1.000	0.061	0.240
Sch 70	8808	0.000	1.000	0.048	0.214
Sch 71	8808	0.000	1.000	0.034	0.181
Sch 72	8808	0.000	1.000	0.059	0.236
Sch 74	8808	0.000	1.000	0.036	0.187
Sch 85	8808	0.000	1.000	0.046	0.210
Sch 86	8808	0.000	1.000	0.052	0.221
Sch 87	8808	0.000	1.000	0.053	0.224
Sch 88	8808	0.000	1.000	0.028	0.166
Sch 81	8808	0.000	1.000	0.048	0.213
Sch 82	8808	0.000	1.000	0.038	0.191
Sch 84	8808	0.000	1.000	0.047	0.212
Sch 173	8808	0.000	1.000	0.033	0.179
Sch 273	8808	0.000	1.000	0.022	0.148
O 16	8808	0.000	1.000	0.000	0.011
O 17	8808	0.000	1.000	0.000	0.011
O 15	8808	0.000	1.000	0.000	0.011
O 50	8808	0.000	1.000	0.000	0.011
Valid N (listwise)	8808				

Figure 40 - Capistrano Absenteeism/Tardiness Descriptive Statistics

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